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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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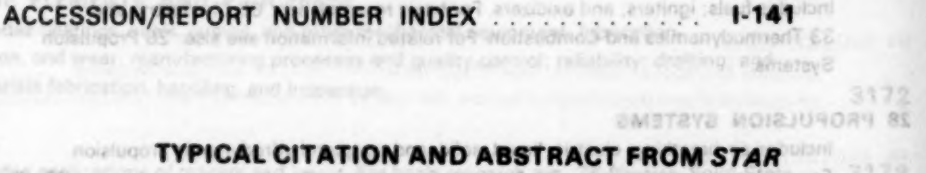
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Scientific and Technical Aerospace Reports

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N70-32058*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

TABLE OF VALUES OF INTEGRALS FOR THE LONGITUDINAL AND LATERAL VON KARMAN TURBULENCE SPECTRA

Douglas D. Mackiernan 15 Jun. 1970 29 p ref

(NASA-TM-X-64529) Avail: CFSTI CSCL 01A

The longitudinal and lateral von Karman turbulence spectra are integrated over the domain L omega sub c < L omega < infinity, where L is the integral scale of turbulence, omega is a wave number and omega sub c is a cut-off wave number which defines the lower bound of integration. The integration procedure consists of expanding the spectra in Maclaurin series and integrating the resulting series term by term to yield tables as functions of L omega sub c, contributions to the longitudinal and lateral deviations of turbulence from the Fourier components in the wave number domain. The total longitudinal and lateral standard deviations are both equal to sigma which is obtained by setting omega sub c = 0. A sample calculation is provided to aid the user. Author

N70-32148# Royal Aircraft Establishment, Farnborough (England).

COMMENTS ON THE APPROXIMATE SOLUTION OF THE CLASSICAL FLUTTER PROBLEM [BEMERKUNGEN ZU DER ANGENAEHERTEN LOESUNG DES KLASSISCHEN FLATTERPROBLEMS]

H. G. Natke Jul. 1969 22 p refs Transl. into ENGLISH from Z. Flugwiss. (Germany), v. 15, no. 11, 1967 p 425–437

(RAE-Lib-Trans-1296) Avail: CFSTI

Solution possibilities for the flutter problem as applied in practice are briefly reviewed and discussed without using a special aerodynamic theory. The relations between different solutions for a system with n degrees of freedom are given and demonstrated with an example. Author

N70-32486*# Stanford Univ., Calif. Thermosciences Div.

EXPERIMENTAL HYDRODYNAMICS OF THE ACCELERATED TURBULENT BOUNDARY LAYER WITH AND WITHOUT MASS INJECTION

H. L. Julien, W. M. Kays, and R. J. Moffat Mar. 1970 34 p refs

(Grant NGR-05-020-134)

(NASA-CR-110650; HMT-10) Avail: CFSTI CSCL 20D

Mean velocity profile data are reported for blown, unblown, and sucked accelerated turbulent boundary layers. The pressure gradients investigated are those corresponding to constant values. For each pressure gradient, the surface boundary conditions cover a range of constant blowing and sucking fractions from F = −0.002 to +0.004. Velocity profiles corresponding to these accelerated flows are shown to differ substantially from those characteristic of zero pressure gradient flows. For each case of a constant acceleration, sequential values of the momentum thickness Reynolds number approach a specific constant, and the velocity distributions near the wall are similar in both wall coordinates and outer coordinates. Results obtained here can be reproduced by a numerical integration of the boundary layer equations using a modification of the Van Driest damping factor, A(+), derived from the data presented here. The A(+) correlation is presented. Author

N70-32484# Naval Ordnance Lab., White Oak, Md.

THE JOINT NOL/RAE/WRE RESEARCH PROGRAM ON BOMB DYNAMICS. PART 2: A LOW-DRAG BOMB WITH SPLIT-SKIRT STABILIZERS

F. J. Regan, J. H. W. Shannon (Weapons Res. Estab., Adelaide), and F. J. Tanner (RAE) 31 Dec. 1969 48 p refs

(AD-704785; NOLTR-69-232; RAE-TR-70038) Avail: CFSTI CSCL 19/2

Research on the free-fall dynamics of bombs has been conducted as a cooperative program supported by organizations in the United States, United Kingdom and Australia. In addition to full-scale flight trials of instrumented research stores carried out by the Australian Weapons Research Establishment (WRE), wind-tunnel tests have been made on mutually agreed models at the Aircraft Research Association and Royal Aircraft Establishment (RAE) in England; the Naval Ordnance Laboratory (NOL) in the United States; and at the Aeronautical Research Laboratory in Australia. RAE, WRE and NOL have separately prepared digital-computer programs to simulate test vehicle trajectories using wind-tunnel measurements as inputs. Correlation between the predicted and observed flight results have provided considerable insight into problems associated with dynamic behavior during the critical release phase and stability criteria needed for good ballistics consistency. This is the second report on the research program and it presents results relating to the study of split-skirt stabilizers. Author (TAB)

N70-32533*# Scripta Technica, Inc., Washington, D.C.

A METHOD OF CALCULATING SUPERSONIC FLOW AROUND BLUNTED BODIES WITH DETACHED SHOCK WAVES [METOD RASCHETA SVERKHZVUKOVOGO OBTEKANIYA ZATUPLENNYKH TEL S OTOSHEDSHEY UDARNOY VOLNOY]

S. M. Gilinskiy et al NASA Jul. 1970 35 p refs Transl. into ENGLISH from Sb. Rab. Vychisl. Tsent. (Moscow), no. 6, 1967 p 173–205

(Contract NASw-2036)

(NASA-TT-F-13026) Avail: CFSTI CSCL 20D

The problem of the supersonic flow past bodies with a

detached shock wave is formulated on the basis of an analysis of the properties of solutions of linear equations of elliptic and mixed types. A numerical method for solving the nonlinear problem is described. Telenin's method is applied to the solution of various problems involving flows past bodies with a detached shock wave. Author

N70-32535*# Scientific Translation Service, Santa Barbara, Calif.
HOT GAS RECIRCULATION MEASUREMENTS ON FOUR DIFFERENT-SIZE MODELS OF A SIMPLE VTOL CONFIGURATION [HEISSGAS-REZIRKULATIONSMESSUNGEN AN VIER VERSCHIEDEN GROSSEN MODELLEN EINER EINFACHEN VTOL-KONFIGURATION]
R. Jenny Washington NASA Jul. 1970 21 p refs Transl. into ENGLISH from 6th ICAS Congr., Munich, 9–13 Sep. 1968, Paper 68-12 p 1–10
(Contract NASw-2035)
(NASA-TT-F-12604) Avail: CFSTI CSCL 20D

Investigation of the influence of the size of the wind tunnel and the temperature of the jet stream on the recirculation behavior of a VTOL configuration. It is found that the relationship between the sizes of the wind tunnel and the VTOL model is quite critical. Author

N70-32558# Rochester Applied Science Associates, Inc., N.Y.
STUDY OF MODIFICATION OF ROTOR TIP VORTEX BY AERODYNAMIC MEANS Interim Technical Report, 1 Feb. 1969–31 Jan. 1970
Stephen A. Rinehart Jan. 1970 56 p refs
(Contract N00014-69-C-0169)
(AD-704804; RASA-70-02) Avail: CFSTI CSCL 1/3

Numerous research efforts have been conducted by different investigators to alter the characteristics of the tip vortex generated by a helicopter blade in order to alleviate the blade-vortex interaction problem as well as the noise problem associated with impulsive loading. The analytical investigation shows that it should be possible to significantly alter the characteristics of the trailing tip vortex for all flight conditions in a beneficial manner by injecting an airstream directly into the forming tip vortex. Analytical expressions were developed for the initial and final states of the vortex in order to evaluate the effects of mass flow injection on the vortex strength, swirl velocity distribution, vortex core pressure, vortex core size and the induced drag on the blade. On the basis of the results that were obtained, it was shown that the required mass flow may be obtained from centrifugal pumping action by venting the blade and therefore the desired modification can be obtained apparently without significant performance penalties which would be unacceptable. Author (TAB)

N70-32571*# Techtran Corp., Glen Burnie, Md.
AERODYNAMIC COEFFICIENTS FOR CONTROL SURFACE-TAB COUPLING IN SUBSONIC, BIDIMENSIONAL, UNSTEADY FLOW [COEFFICIENTS AERODYNAMIQUES DE COUPLAGE GOUVERNE-TAB, EN ECOULEMENT SUBSONIQUE BIDIMENSIONNEL INSTATIONNAIRE]
R. Dat et al Washington NASA Feb. 1970 8 p refs Transl. into ENGLISH from Rech. Aerosp. (France), no. 129, Mar.–Apr. 1969 p 60–63
(Contract NASw-1695)
(NASA-TT-F-12829) Avail: CFSTI CSCL 20D

An approximate method of calculation of the aerodynamic coefficients in question is presented and the results are compared with figures from tables based on an exact theory. The results are found to be extremely close in incompressible flow and satisfactory, though more divergent, for compressible flow. Author

N70-32613# ARO, Inc., Arnold Air Force Station, Tenn.
DYNAMIC CHARACTERISTICS OF A 9-DEG CONE WITH AND WITHOUT ASYMMETRIES AT MACH NUMBER 10 Final Report, 1 Nov. 1968–30 Jun. 1970
L. K. Ward, Jr. and A. C. Mansfield AEDC Mar. 1970 25 p refs
(Contract F40600-69-C-0001)
(AD-702448; AEDC-TR-70-1) Avail: CFSTI CSCL 20/4

Wind tunnel tests were conducted at Mach number 10 on a 9 deg half angle cone model using a unique dynamic stability balance having three angular degrees of freedom. Data obtained at Re sub l = 1,970,000 on models having different types of compound asymmetries have revealed vast differences in the developed motion. A model with a center of gravity offset and a small, out of plane nose slice as the second asymmetry was found to have a totally unexpected type of instability. The instability was the rapid divergence of the precession arm caused by a Magnus type moment resulting from an out of plane force generated by the nose slice. When the slice was removed (sharp nose model), and the second asymmetry applied by using a small tab at the base, the classical roll resonance was found. Author (TAB)

N70-32614# ARO, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF LAMINAR BOUNDARY-LAYER SEPARATION ON A FLAT-PLATE-RAMP COMBINATION WITH AND WITHOUT MASS REMOVAL AT MACH NUMBERS 6, 8, AND 10 Final Report, 11 Jul. 1965–18 Apr. 1969
R. W. Rhudy AEDC Mar. 1970 66 p refs
(Contract F40600-69-C-0001)
(AD-702078; AEDC-TR-69-199) Avail: CFSTI CSCL 20/4

An experimental investigation of laminar boundary-layer separation induced by a trailing edge ramp on a flat plate was conducted at Mach numbers of 6, 8, and 10. The tests were conducted over a range of Reynolds numbers. Longitudinal and spanwise surface pressure distributions, pitot pressure profiles, and shadowgraph pictures were used to investigate the two-dimensionality of the flow and the effects of model geometry, angle of attack, Reynolds number, ramp angle, and mass removal from the separation region. Data are presented to show that laminar, two-dimensional boundary-layer reattachment, not limited by model geometry, was obtained. These data are compared to the integral-moment theory of Lees and Reeves as modified by Klineberg. It is also shown that a separation region can be reduced or even eliminated by removing mass at the hinge line. Author (TAB)

N70-32641# Air Force System Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL METHOD OF MEASUREMENT OF TURBULENCE IN WIND TUNNELS
B. Ya. Trubchikov 11 Mar. 1970 81 p refs Transl. into ENGLISH from Tr. Tsentr. Aerogidrodinamicheskii Inst. (USSR), no. 372, 1938 p 1–44
(AD-704773; FTD-MT-24-419-69) Avail: CFSTI CSCL 20/4

The report discusses the general theory of diffusion in a turbulent flow and forms the basis of the method of measurement of turbulence in wind tunnels by studying the diffusion of heat behind a thin heated wire. Cited are results of measurements of temperature of velocity fields behind a round cylinder, conducted with a wide range of changes of relative distance from the cylinder. A description is given of the measuring equipment and basic results of investigations, connected with development of the method and technology of the experiment. Results of measurements by the thermal method are compared with other methods. In conclusion there are cited results of investigation of turbulence of flow in a number of wind tunnels by the thermal method. (Author) TAB

N70-32827*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC INTERFERENCE EFFECTS ON HALF-CONE

BODIES WITH THIN WINGS AT MACH 10.03
James C. Townsend Washington Jul. 1970 25 p refs
(NASA-TN-D-5898; L-6487) Avail: CFSTI CSCL 20D

Halves of cone bodies having fineness ratios of 2, 4, or 6 were tested with thin flat wings at Mach 10.03 and Reynolds numbers of 1.2, 1.5, or 1.8 million. Several wing planforms designed empirically or theoretically to match the shape of the shock wave about the body were investigated for each fineness ratio. Tests were also made with thick wings and with wings having various leading edge shapes. The wing planforms which matched the actual shock shape provide the highest lift-drag ratios. Increasing the fineness ratio of the half-cone body increases the lift-drag ratio but decreases the lift coefficient. Effects of wing thickness and leading edge shape were very small. Author

N70-32844*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC AND DEPLOYMENT CHARACTERISTICS OF SINGLE-KEEL SOLID AND SINGLE-KEEL SLOTTED PERSONNEL PARAWINGS
Harry L. Morgan, Jr. and Charles F. Bradshaw Washington Jul. 1970 36 p refs
(NASA-TN-D-5911; L-6590) Avail: CFSTI CSCL 01C

Wind-tunnel and free-flight tests were performed to determine the gliding-flight and deployment characteristics of single-keel solid and single-keel slotted parawings of suitable size for use in personnel recovery systems. The tunnel tests showed that both wings had almost identical maximum lift-drag ratios and modulations of lift-drag ratio and that the slotted wing had slightly lower values and less modulation of resultant-force coefficient than the solid wing. Free-flight deployment tests of solid and slotted personnel parawings equipped with 235-pound torso dummies showed that the maximum deployment loads were lower and the canopy inflation times were longer for the slotted wing than for the solid wing over a range of pack opening velocities. A comparison of the deployment loads of the two personnel parawings and a currently used personnel parachute showed that the parawings had much greater deployment loads than the parachute. Author

N70-32892*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYPERSONIC BLUNT-BODY FLOW OF A RADIATING GAS AT LOW DENSITY
W. A. Schneider 1 Jul. 1970 32 p refs
(Contract NAS7-100)
(NASA-CR-110728; JPL-TR-32-1451) Avail: CFSTI CSCL 20D

The effect of radiation on hypersonic viscous flow at low densities is studied. Cheng's two-layer flow model (dividing the flow field into a thin shock layer and a thin shock transition zone) is used to simplify the Navier–Stokes equations. Radiation is taken into account by adding an emission term to the energy equation. Because of the low density, self-absorption may be neglected but nonequilibrium effects become important. Estimates show that vibration, dissociation, and ionization can be assumed to be frozen in the density-velocity regime of interest, but the process of electron excitation has to be investigated on the basis of finite relaxation times. Rate equations for emission due to nonequilibrium radiation from various band systems are derived, and the effect of collision limiting is discussed in the light of these equations. The rate constants for the most important molecular band systems in air are determined experimentally. Finally, numerical results for the flow field in the stagnation region and for the heat transfer coefficient are discussed. Author

N70-32894# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE POSITION OF THE STAGNATION POINT IN THREE-DIMENSIONAL HYPERSONIC FLOW AROUND SEGMENTAL BODIES
B. A. Zemlianskii 1970 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 1, 1970 p 164–168
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The position of the stagnation point in hypersonic flow around a spherical segment is studied for reentry vehicles of the Apollo and Soiuz types. The fundamental characteristic parameter in the transonic region is considered to be gas compression in a normal shock. A semi-empirical method is proposed which permits estimates of the fundamental parameters characterizing the flow of the three-dimensional stagnation point. Ratios for the influence of a shift in the stagnation point on the heat exchange is laminar flow are given. F.O.S.

N70-33169*# Translation Consultants, Ltd., Arlington, Va.
SOME SELF-SIMILAR SOLUTIONS OF THE PROBLEM OF AN INTENSE BLAST AT A PLATE IN A SUPERSONIC FLOW [NEKOTORYYE AVTOMODEL'NYYE RESHENIYA ZADACHI O SIL'NOM VDUVE CHEREZ PLASTINKU V SVERKHZVUKOVOM POTOKE]
A. M. Antonov et al Washington NASA Jun. 1970 7 p refs Transl. into ENGLISH from Prikl. Mekh. (Ukrania SSR), v. 5, no. 10, 1969 p 111–114
(Contract NASw-2038)
(NASA-TT-F-12964) Avail: CFSTI CSCL 20D

The solution to the problem of the flow of a gas blast at a flat plate when the gas blast is normal to the incoming flow is discussed. Author

N70-33230*# Scientific Translation Service, Santa Barbara, Calif.
PROPULSIVE EVALUATION OF A RAMJET INSTALLED UNDER A WING UP TO MACH 7 [BILAN PROPULSIF, JUSQU'A MACH 7, D'UN STATOREACTEUR MONTE SOUS UNE AILE]
C. Huet Washington NASA May 1970 26 p refs Transl. into ENGLISH from Rech. Aerospatiale (Chatillon-sous-Bagneux), no. 133, Nov.–Dec. 1969 p 3–14
(Contract NASw-2035)
(NASA-TT-F-12951) Avail: CFSTI CSCL 20D

Taking advantage of the compression of the air under the lower surface of a lifting wing leads to the improvement of a ramjet, and makes easier the solution of technological problems. With such a design it is possible to make do a fixed geometry engine between Mach 3 and Mach 7. The air intake takes place without incidence and at a lower Mach number ($2.8 < M < 5$). The main flight mechanics equations applicable in this case are given. The notion of induced thrust, due to the flight incidence, is introduced. On a numerical example, the performance increase due to this ramjet position is analyzed; it is shown, in particular, that with this design the engine cross section can be reduced two to threefold. Author

N70-33249# Sandia Corp., Albuquerque, N. Mex. Library Operations Div.
THERMAL LOAD OF AN AERODYNAMIC REENTRY BODY AND THE RESULTING OPTIMIZATION AND DESIGN CRITERIA
W. F. Zimi et al 21 Apr. 1970 28 p refs Transl. into ENGLISH from Ann. Conv. of the Ger. Soc. for Aerun. and Astronautics (DGLR), Bremen, 22-24 Sep. 1969
(SC-T-70-4015; CONF-690950-1) Avail: CFSTI

Starting from the description of the physical process of the aerodynamic heating, the computation methods aimed at determining the heat transfer are sketched. The example of the LB 10 elucidates the procedure for the approximated analytical determination of the complex geometric form of a reentry body. The maximal heat load is situated in an altitude velocity area where the boundary layer is laminar in the vicinity of the ram point. For this reason, it is possible to solve the heat transfer by employing

an exact integration of the boundary layer equations for simple bodies. Among the conceivable heat protection possibilities, such as ablation, active cooling, radiative cooling, the passive radiation-cooled multiple-layer insulation provides the most favorable insulating type for a reusable missile. An insulation coefficient is derived which makes it possible to classify various materials in terms of their serviceability as insulants. Author

N70-33274# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE DETERMINATION OF UNSTEADY AERODYNAMICS OF A TWO-DIMENSIONAL JET-FLAP WING Final Technical Report, Apr. 1966 - Mar. 1970
Andrew R. Trenka and John C. Erickson, Jr. Apr. 1970 97 p refs
(Contract DA 31-124-ARO(D)-459)
(AD-704722; CAL-AC-2260-S-1) Avail: CFSTI CSCL 1/3

One of the purposes of the study was to conduct wind-tunnel tests on a two-dimensional, oscillating, jet-flap airfoil to determine the unsteady forces, moments, and pressure distributions. These tests were to (1) provide data for testing the validity of the theoretical results, and (2) to furnish guide-lines for the further development of unsteady jet-flap airfoil theory. The study was also to extend the solutions to the general theoretical equations describing the unsteady motions of a jet-flapped airfoil executing simple harmonic pitching motions. The attainment of these objectives was pursued in three phases. The first consisted of the development, calibration and testing of the model and its recording system. The second phase dealt with the theoretical effort required to allow computation of the lift and moment acting on a two-dimensional jet-flap airfoil executing harmonic pitching motions. The third and final phase consisted of the correlation of theory and experiment and the assessment of the theory. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-32069# Serendipity Associates, Los Angeles, Calif.
CORRECTION OF HOVER FLIGHT TEST RESULTS TAKEN IN WIND
W. Mc Intyre, R. Begley, and M. Brown Mar. 1970 158 p refs
(Contract DAAJ01-69-C-0215)
(AD-704349; TR-70-2) Avail: CFSTI CSCL 1/2

This report presents a procedure for analytically correcting for the effect of wind (dewinding) on a hovering helicopter. This procedure will be much more cost effective than the current method which requires lengthy delays until the wind speed drops below two knots. Dewinding is accomplished by application of the equations of motion and consideration of control changes to flight test data recorded on an incremental digital recording system. An experimental program is outlined to determine first the effective wind acting on a hovering helicopter and second the effect this wind has on the helicopter. Author (TAB)

N70-32245# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
THE SAFETY SIGNIFICANCE OF AIRCRAFT ACCIDENT POST MORTEM FINDINGS
A. V. Siegel, S. R. Mohler, and A. Cierebiej Oct. 1969 19 p refs Presented at 7th Sci. Session of the Joint Comm. on Aviation Pathol., Halton, England, 15 Oct. 1969
(AD-704473; FAA-AM-69-*8) Avail: CFSTI CSCL 1/2

A review of post mortem examinations obtained in 1968 of pilot victims of general aviation aircraft accidents reveals that 51 percent of the pilot victims were studied by pathologists. The post mortem examination population above was taken from 687 pilot fatalities in general aviation accidents occurring within the United States in 1968. The percent of post mortem examinations obtained in 1968 represents considerable progress in comparison to earlier years. Without an aircrew autopsy, the probable cause almost always consists of a higher proportion of conjecture than is otherwise the case. The full utility of the important data resulting from these examinations is going to depend, however, upon the addition of certain quantitative data to that in the current verbally descriptive protocol almost universally encountered. This is particularly pertinent in relation to computer assisted analytic studies of broad scale concerning post mortem findings. Author (TAB)

N70-32259*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINATION OF INFLATED SHAPE AND INERTIAL PROPERTIES OF AN ALL-FLEXIBLE PARAWING
Blair B. Gloss Washington Jul. 1970 33 p refs
(NASA-TN-D-5900; L-6906) Avail: CFSTI CSCL 01C

The inflated shape of a single-keel, all-flexible parawing with a 45° leading-edge sweep and a 5-foot keel length has been determined by using photogrammetric technique. The shape of this parawing was determined at lift-drag ratios of 2.13, 2.24, and 2.43 with the wing in tethered flight in a wind tunnel. The shape data for the inflated parawing showed a 3.0 percent increase in the span and a 3.0 percent decrease in the keel length when the lift-drag ratio increased from 2.13 to 2.43. The nondimensional inertial properties and center of gravity locations of the parawing structure were calculated from the shape data. The inertial properties and center of gravity locations calculated for a geometrically similar parawing with a 24-foot keel length were in excellent agreement with measured values obtained from pendulum tests. Author

N70-32317# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
IFR FORMATION FLIGHT DISPLAY/SYSTEM REQUIREMENTS FOR ADVANCED ROTARY-WING AND JET-FIGHTER AIRCRAFT Final Technical Report, Jun. 1968 - Jun. 1969
Paul A. Anderson, Myrna L. Toivanen, and R. B. Hoppe Mar. 1970 315 p refs
(Contract N00014-68-C-0362)
(AD-705133; Honeywell-12543-FR5; JANAIR-690616) Avail: CFSTI CSCL 1/4

The study was conducted to investigate information and display requirements for a manual IFR formation flight system for an advanced rotary-wing and a high-performance jet fighter. This investigation included the study of the effects of varying the rate at which new information is available for display and the level of measurement noise in the information presented. Two alternative vertical situation display formats were selected for evaluation. Systematic man-in-the-loop simulations were conducted to collect pilot performance data for these two display formats at three levels of the data update rate and measurement noise variables. Performance measures recorded included the follower aircrafts deviations from the assigned command position, rates of pilot control input activity, and frequency of aircraft control losses. Author (TAB)

N70-32338# Boeing Co., Seattle, Wash. Military Airplane Systems Div.
COCKPIT GEOMETRY EVALUATION. PHASE 1. VOLUME

2: HUMAN DATA Final Report, 15 Jan. –31 Dec. 1968
Wayne E. Springer and Patrick W. Ryan Jan. 1969 309 p refs
(Contract N00014-68-C-0289)
(AD-703268; D162-10126-1; JANAIR-690102) Avail: CFSTI CSCL 5/5

A computerized dynamic man-model is being developed as part of a contract administered by the Office of Naval Research (ONR) through the auspices of the Joint Army Navy Aircraft Instrumentation Research (JANAIR) Program Working Group. The baseline man-model to be developed in the first year of the proposed six-year program is a 23-joint articulated link stick-man. The anthropometric, joint angular limit, mass, and visual characteristics used for the initial man-model (BOEMAN-I) are listed in this document. Present literature has been used whenever possible to provide these data. Boeing researchers have supplemented the literature information to complete that needed for BOEMAN-I. Author (TAB)

N70-32339# Boeing Co., Seattle, Wash. Military Airplane Systems Div.
COCKPIT GEOMETRY EVALUATION, PHASE 1. VOLUME 3: COMPUTER PROGRAM Final Report, 1 Jan. –31 Dec. 1968
Robert Katz, Michael J. Healy, and Gary O. Meeker 20 Jan. 1969 261 p refs
(Contract N00014-68-C-0289)
(AD-703269; D162-10127-1; JANAIR-690103) Avail: CFSTI CSCL 5/5

A computer program for the evaluation of cockpit configurations using a 23 pin-joint articulated stick-man (BOEMAN-I) is presented. This program utilized an updatable bank of anthropological and environmental data, and simulates the motion of a real pilot performing tasks in a crewstation. The program provides information concerning reach capability, locations and orientations of joints, pilot-cockpit visual interferences, numerical performance indicators on joint displacement and deflection, and mass displacements. The program provides also a statistical validation when comparing real pilot and BOEMAN-I paths of motion. Author (TAB)

N70-32340# Boeing Co., Seattle, Wash. Military Airplane Systems Div.
COCKPIT GEOMETRY EVALUATION, PHASE 1. VOLUME 4: MATHEMATICAL MODELS Final Report, 15 Jan. –31 Dec. 1968
Michael J. Healy and Robert Katz Jan. 1969 101 p refs
(Contract N00014-68-C-0289)
(AD-703270; D162-10128-1; JANAIR-960104) Avail: CFSTI CSCL 5/5

A mathematical model that positions and moves a variable sized 23-pin joint articulated stick-man in a crewstation environment is presented. The model simulates the motion of pilots in a given cockpit configuration considering gross reach capability required by a task. It utilizes a non-linear optimization technique to position and orient the joints, analyzes the viewing capability after the operation and detects body intersections with the seatback during the task. Author (TAB)

N70-32341# Boeing Co., Seattle, Wash. Military Airplane Systems Div.
COCKPIT GEOMETRY EVALUATION, PHASE 1. VOLUME 5: VALIDATION Final Report 15 Jan. –31 Dec. 1968
Patrick W. Ryan Jan. 1969 99 p refs
(Contract N00014-68-C-0289)
(AD-703271; D162-10129-1; JANAIR-690105) Avail: CFSTI CSCL 5/5

A baseline 23-joint variable link length man-model was developed. Three-space movement of the upper torso has been developed utilizing mathematical and computer techniques. Rigorous validation criteria developed held that the model must closely simulate the joint movement paths and the maximum reach envelopes of any sized human operator workstation. Human joint movement data was obtained using a multiple camera technique. Seven seated subjects repeatedly performed movements in an open space and in a multimission flight simulator. A rigorous statistical analysis compared the synthesized arm joint locations of the man-model with those of the subjects. The comparisons were made at joint locations of each task where the greatest discrepancies between the model and the subjects were expected to occur. In general, the results indicated that statistical differences occur; however, practically, they appear negligible. Therefore, the concept of a mathematical man-model appears feasible and future efforts should continue to refine and improve the model as well as the validation criteria and methods. Author (TAB)

N70-32446# Raven Industries, Inc., Sioux Falls, S.Dak. Flight Operations Dept.
SKYHOOK CHURCHILL 1969
Charles H. Cravaack and Thomas Pappas 12 Jan. 1970 239 p
(Contract N00014-69-C-0239)
(AD-703262; R-017001) Avail: CFSTI CSCL 4/1

The Skyhook Churchill Program originated in 1959 when five scientific experiments were flown on polyethylene balloons. Subsequent years found increasing numbers of scientists participating in this program. The 1969 Skyhook crew was in the field at Fort Churchill for a period of six weeks. Secondary phases were conducted at Resolute Bay, Cornwallis Island, N.W.T., Canada where one flight was launched during a twenty day period and at Sioux Falls, with the launching of four flights during the month of September. Author (TAB)

N70-32530# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF A LOW-COST VISUAL APPROACH SLOPE INDICATOR (VASI) AS A PILOT TRAINING AID Final Report, Jun. –Dec. 1969
Warren G. Crook May 1970 29 p
(FAA-DS-70-4; FAA-NA-70-18) Avail: CFSTI

The effectiveness of a simple low-cost Visual Approach Slope Indicator (VASI) in developing and reenforcing proper aircraft control technique during approach and landing under actual pilot training conditions is determined. A simplified two-box, single-lamp system was evaluated at two pilot training schools which summarized the results of training given to comparable groups of student pilots instructed with and without the use of the abbreviated VASI. Results showed that the simplified VASI made flight instruction easier enabling the students to quickly grasp the fundamentals of final approach glide path control. VASI-trained students made better, safer approaches earlier in their training than the regular students trained without it and had no trouble subsequently landing without benefit of the system during daylight or nighttime approaches. The system provided reliable visual guidance and good sensitivity for glide path control within its design capability of 1 to 1.5 miles. Maximum benefit of the system appeared to be derived during night approaches where judgment of altitude is difficult. Author

N70-32760*# Aerophysics Research Corp., Bellevue, Wash.
APPLICATION OF THE VARIATIONAL STEEPEST-DESCENT METHOD TO HIGH PERFORMANCE AIRCRAFT TRAJECTORY OPTIMIZATION
Donald S. Hague [1970] 80 p refs
(Contract NAS2-5383)
(NASA-CR-73366) Avail: CFSTI CSCL 01C

The variational steepest-descent method is applied to a variety of aircraft and aircraft performance problems. Vehicle types employed in the calculations consist of a typical next-generation hypersonic research aircraft and a supersonic transport configuration.

Performance problems considered include minimum time-to-climb, minimum fuel ascents, maximum range, and minimum range (the return to base problem). Solutions are obtained for a variety of terminal constraints including velocity, altitude, and flight path angle. In several cases, in-flight inequality constraints are imposed on vehicle state and control functions including maximum altitude, throttle setting, acceleration, and flight path angle. The inequality constraints are imposed either separately or in combination. Control variables employed include angle-of-attack, pitch angle, bank-angle, and throttle setting. Convergence to the optimal solution is obtained automatically by a second-order step-size criteria in combination with artificial intelligence in the form of programmed logical decisions. The program employed was subject to the limitations of a single vehicle (or at most two vehicles, one of which is in a prespecified circular planetary orbit) and to employment of stages at fixed times. Author

N70-32770*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
EVALUATION OF THE EFFECT OF A YAW-RATE DAMPER ON THE FLYING QUALITIES OF A LIGHT TWIN-ENGINE AIRPLANE
Calvin R. Jarvis, Paul C. Loschke, and Einar K. Enevoldson Washington Jul. 1970 47 p refs
(NASA-TN-D-5890; H-584) Avail: CFSTI CSCL 01C

A flight-test program was conducted with a light twin-engine airplane to determine the effect of a parallel yaw damper and aileron-to-rudder interconnect on the flying qualities of this class of aircraft. Both quantitative and qualitative results are presented for several flight tasks and conditions, including flight in turbulence. Airplane handling qualities and ride qualities are summarized. The effect of the yaw damper on the stall and post-stall motions of the test airplane and the motions resulting from sudden engine failure are also discussed. Author

N70-32884*# Goodyear Aerospace Corp., Akron, Ohio.
DESIGN OF DISK-GAP-BAND AND MODIFIED RINGSAIL PARACHUTES AND DEVELOPMENT OF BALLUTE APEX INLET FOR SUPERSONIC APPLICATION
G. L. Faurote 6 Apr. 1970 109 p refs
(Contract NAS1-8564)
(NASA-CR-66909; GER-14657) Avail: CFSTI CSCL 01C

The design and fabrication of flexible wind-tunnel decelerator configurations for use by NASA Langley Research Center in its Ground Test Decelerator Program is presented. The models included fabric disk-gap-band and ring-sail parachutes and ram-air-inflated towed Ballutes. In addition, the design of disk-gap-band and Ballute solid pressure models is presented. All configurations were designed for test in a supersonic-flow regime. Author

N70-32921# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
A STUDY OF AN ADAPTIVE AIRCRAFT CONTROL SYSTEM IN A SELF-ORGANIZING CONFIGURATION
Henry Morgan Richards, Jr. (M.S. Thesis) Oct. 1969 51 p refs
(AD-703656) Avail: CFSTI CSCL 1/3

An adaptive control scheme may provide the best approach to the problem of accommodating automatic flight control systems to the variations of dynamic characteristics encountered over the flight envelope of the aircraft. The C*-Criterion for aircraft time response provides a basis for the design of such a system. To provide a margin of safety, all control systems have redundant channels for emergency use. An adaptive control system can be designed to be self-organizing, and in such a configuration can provide its own failure monitoring, resulting in a simpler and more efficient system. This study shows that such a system is feasible, that the response of the system is within the limits set forth in the C*-Criterion, and that the self-organizing characteristics provide reliable operation over the whole range of flight operations. Author (TAB)

N70-32947*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF THE FIELD OF SOUND PRODUCED BY A JET AIRCRAFT IN MOTION [DETERMINATION DU CHAMP SONORE PRODUIT PAR L'EVOLUTION DES AVIONS A REACTION]
M. Kobrynski Washington NASA Jul. 1970 22 p refs Transl. into ENGLISH of French Report ONERA-TP-687 Presented at AGARD Meeting on Aircraft and Sonic Boom Noise, Saint-Louis, France, 27–30 May 1969
(Contract NASw-2035)
(NASA-TT-F-13096; ONERA-TP-687) Avail: CFSTI CSCL 20A

The relation between the global sound pressure field generated by an axisymmetrical stationary jet and that produced by a moving jet, observed from a fixed point on the ground, is studied through the introduction, in the generalized sound pressure equation, of a new convection parameter derived from the Ribner expression. This new equation confirms the known results in the maximum sound direction and gives a better value in the other directions. The results of the analytical study, confirmed by many experimental results, show that, in the directions other than that of maximum pressure, the relative speed is not the significant parameter for determining the local total sound pressure level. Author

N70-33255* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE SWEEP WING CONFIGURATION Patent
William J. Alford, Jr. and Edward C. Polhamus, inventors (to NASA) Issued 11 Sep. 1962 (Filed 7 Jul. 1960) 5 p Cl. 244-43
(NASA-Case-XLA-00230; US-Patent-3,053,484;
US-Patent-Appl-SN-41455) Avail: US Patent Office CSCL 01C

The design of an improved variable sweep wing planform for a supersonic aircraft is described. The variable aspect ratio wing is designed for use in an aircraft having a conventional fuselage including a conventional aft empennage assembly and fuselage carried propulsion engines, wings projecting from the sides of the fuselage including fixed swept inboard panels constituting about 20 percent of the total wing area, with about one half of the area of the fixed panels being located forward of the aircraft center of gravity, and outboard panels extending outwardly from the fixed inboard panels and pivotally connected for rotation in the wing areal plane to vary the leading edge sweep between a small angle of about 25 degrees and a large angle of about 75-80 degrees. A.L.

N70-33266* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE SWEEP WING AIRCRAFT Patent
Thomas A. Toll, inventor (to NASA) Issued 20 Nov. 1962 (Filed 23 Aug. 1960) 6 p Cl. 244-46
(NASA-Case-XLA-00221; US-Patent-3,064,928;
US-Patent-Appl-SN-51473) Avail: US Patent Office CSCL 01C

Variable aspect ratio and variable sweep delta wing planforms are discussed for supersonic aircraft. The aspect ratio of the delta wing can be varied without affecting the control and stability characteristics of the aircraft. The design configuration provides maximum aspect ratio for subsonic takeoff, climb, cruise, descent, and landing. The supersonic performance of the aircraft is also improved by altering the sweep of the wing during supersonic cruise. R.B.

N70-33268*# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
ACTIVE COOLING OF HYPERSONIC AIRPLANES
Antonio Ferri, Herbert Fox, and Walter Hoydysh Jan. 1970 75 p refs

(Grant NGR-33-016-131)
(NASA-CR-86930) Avail: CFSTI CSCL 01C

A combined turbine-compressor system is discussed for application to active cooling of hypersonic airplanes. The basic system analysis is discussed and performance variation analyzed. The various parameters of importance are discussed with their pertinent effects on the system operation displayed. The penalties of the system are shown to be smaller than with other active cooling systems. Author

N70-33286* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LANDING ARRANGEMENT FOR AERIAL VEHICLES Patent
John M. Riebe and Vernard E. Lockwood, inventors (to NASA) Issued 3 Apr. 1962 (Filed 2 May 1960) 7 p Cl. 244-46
(NASA-Case-XLA-00142; US-Patent-3,028,122; US-Patent-Appl-SN-26375) Avail: US Patent Office CSCL 01C

Details are presented on a configuration which is capable of being positioned in a low aspect ratio attitude for high speed flight and also in a high aspect ratio attitude for low speed flight, takeoff, or landing. The planform configuration is characterized by large in-flight aspect ratio variation capabilities, and aerodynamic lift capabilities exceeding in the increase in lift obtainable by increasing the aspect ratio. These are provided by an elongated fuselage or hull section, jet means for yawing the fuselage section, and means of increasing aerodynamic lift. N.E.N.

N70-33332* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JET AIRCRAFT CONFIGURATION Patent
Francis M. Rogallo, John M. Riebe, and John G. Lowry, inventors (to NASA) Issued 11 Jul. 1961 (Filed 6 May 1959) 4 p Cl. 244-12
(NASA-Case-XLA-00087; US-Patent-2,991,961; US-Patent-Appl-SN-811509) Avail: US Patent Office CSCL 01C

An upper surface external flow, jet-flap configuration for a high wing airplane, with improved noise suppression characteristics, is described. The flap is defined as an arrangement for simulating a flap by a jet sheet which augments the lift capabilities of wing section by inducing circulation of the stream around the wing. The design also reduces the danger of trash ingestion, diminishes the ground effect on the lift, and improves the slow speed performance of jet aircraft. N.E.N.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-32051*# AiResearch Mfg. Co., Los Angeles, Calif.
INVESTIGATION AND DEVELOPMENT OF NEW CONCEPTS FOR IMPROVEMENT OF AIRCRAFT ELECTRICAL POWER SYSTEMS Quarterly Progress Report
C. H. Lee 23 Jan. 1970 101 p refs
(Contract NAS12-659)
(NASA-CR-86410; Rept-68-4176(6); QPR-6) Avail: CFSTI CSCL 10B

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3. MAINTAINABILITY AND ITS TRADEOFFS WITH EQUIPMENT COST AND WEIGHT 12 p (See N70-32054 17-03)
4. APPROACH TO DEFINE RELATIVE WEIGHTED FACTORS WHICH DETERMINE SYSTEM EFFECTIVENESS 9 p (See N70-32055 17-09)
5. FAILURE PREDICTION, DETECTION, AND COMPENSATION 25 p (See N70-32056 17-03)

N70-32052*# AiResearch Mfg. Co., Los Angeles, Calif.
OPTIMUM SUPPLY TO AIRCRAFT ELECTRICALLY OPERATED EQUIPMENT
In its Invest. and Develop. of New Concepts for Improvement of Aircraft Elec. Power Systems 23 Jan. 1970 21 p (See N70-32051 17-03)
Avail: CFSTI CSCL 10B

The study on optimum methods of applying electric power to loads was concluded. The loads considered were electric drives for hydraulic pumps and secondary flight controls, electronic loads, lighting loads, and thermoelectric refrigeration loads. Author

N70-32053*# AiResearch Mfg. Co., Los Angeles, Calif.
COMPARISON OF HYDRAULIC, PNEUMATIC, AND ELECTRIC POWER FOR AIRCRAFT ACTUATION SYSTEMS
In its Invest. and Develop. of New Concepts for Improvement of Aircraft Elec. Power Systems 23 Jan. 1970 21 p (See N70-32051 17-03)
Avail: CFSTI CSCL 01C

The three types of actuation systems (hydraulic, pneumatic, and electric) are further compared and the dynamic capability of each system is briefly discussed. Some of the component characteristics of the various systems are investigated since the development of components directly affects system capability. Author

N70-32054*# AiResearch Mfg. Co., Los Angeles, Calif.
MAINTAINABILITY AND ITS TRADEOFFS WITH EQUIPMENT COST AND WEIGHT
In its Invest. and Develop. of New Concepts for Improvement of Aircraft Elec. Power Systems 23 Jan. 1970 12 p (See N70-32051 17-03)
Avail: CFSTI CSCL 01C

The factors which affect maintenance cost are presented. Maintainability and prediction and demonstration techniques are discussed with maintainability design steps to be taken during the design and development period. For the electrical equipment, possible tradeoff areas between maintainability and cost and weight are investigated and illustrated. Author

N70-32056*# AiResearch Mfg. Co., Los Angeles, Calif.
FAILURE PREDICTION, DETECTION, AND COMPENSATION
In its Invest. and Develop. of New Concepts for Improvement of Aircraft Elec. Power Systems 23 Jan. 1970 25 p (See N70-32051 17-03)
Avail: CFSTI CSCL 01B

The advantages of using failure prediction and detection for electrical equipment are presented. The failure mode of the system components and the possible techniques of detecting and predicting these failures are evaluated. Different types of recording systems, display techniques, and sensors are also briefly discussed. Author

N70-32250*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY DESIGNS OF SPACE POWER NUCLEAR REACTOR SHIELDS

Leonard J. Kaszubinski, Henry F. Kacher, and Fred Odar
Washington Jul. 1970 51 p refs
(NASA-TM-X-2038; E-5457) Avail: CFSTI CSCL 10B

Preliminary designs of two 4 pi shield configurations for a SNAP-8 mercury Rankine cycle power system are presented. The shield materials are lithium hydride, tungsten alloy, and depleted uranium. The nuclear heat generated in the shields is discussed and methods of rejecting this heat are suggested. Layout drawings are included that show structural details. A detailed weight breakdown is given for both shields. The number and sizes of the shield penetrations are given. Several problem areas are identified. Author

N70-32275*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT POWER
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 130-148 (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 10B

Power supply developments for future spacecraft are reported. A 400-W dc-to-ac inverter and radioisotope thermoelectric generator power source for the Thermoelectric Outer Planet Spacecraft are described. Research is discussed on gravity effects on silver zinc cells, space environment effects on solar cells, electrical performance of mercury cadmium cells, and radiation environment testing of lithium diffused silicon solar cells. Electrical properties of liquid potassium amalgam electrodes, electric propulsion power conditioning, and requirements for obtaining launch approval of an aerospace nuclear system are also discussed. N.E.N.

N70-32328# Royal Aircraft Establishment, Farnborough (England).
INSTITUTE FOR ENERGY CONVERSION AND ELECTRICAL PROPULSION SYSTEMS [INSTITUT FUER ENERGIEWANDLUNG UND ELEKTRISCHE ANTRIEBE, BERICHTSJAHR 1968] Annual Report, 1968
Jan. 1970 41 p refs Transl. into ENGLISH from DVL Ann. Rept. for 1968
(RAE-Lib-Trans-1401) Avail: CFSTI

A review is given of the work of the Institute on energy conversion and electrical propulsion during 1968. With regard to energy conversion, the object is to convert thermal energy into mechanical energy without the use of mechanical moving parts. The Institute has concentrated its efforts on generators that use the principle of electrical induction, both with a liquid metal and a gaseous plasma as working substance, and also on thermionic converters. With regard to electrical propulsion, the two methods under investigation are an inductive plasma accelerator with standing magnetic waves, and an ion accelerator using a Hall principle. Author

N70-32344*# AiResearch Mfg. Co., Los Angeles, Calif.
INVESTIGATION AND DEVELOPMENT OF NEW CONCEPTS FOR IMPROVEMENT OF AIRCRAFT ELECTRICAL POWER SYSTEMS. 1: A REVIEW OF THE ELECTRICAL POWER SYSTEMS AND EQUIPMENT IN EXISTING COMMERCIAL AIRCRAFT Interim Technical Report
C. H. Lee and J. J. Brandner Aug. 1969 292 p refs
(Contract NAS12-659)
(NASA-CR-110693; Rept-69-5193) Avail: CFSTI CSCL 10A

Information pertaining to the electrical power systems and components on existing commercial aircraft is reviewed to devise optimum electrical power systems for advanced aircraft. Subjects discussed include: configurations and performance requirements, electrical loads and parametric data, distribution systems, generation subsystems, and heat transfer techniques. F.O.S.

N70-32359 National Lending Library for Science and Technology, Boston Spa (England).
RESEARCH ON MERCURIC OXIDE CELLS. 2: THE DISSOLUTION OF ZINC IN KOH SOLUTIONS
Y. Miyake et al 28 Nov. 1969 10 p refs Transl. into ENGLISH from Osaka Kogyo Gijutsu Shikensho Kiho (Osaka), v. 3, no. 2, 1952 p 39-43
(NLL-M-7943-(5828.4F); Rept-7) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relationship between the amount of ZnO dissolving in a KOH aqueous solution of two or three different concentrations, the decrease in the amount of Zn from corrosion, and the amount of gas generated in the solution are considered. The experimental results obtained on the concentration and decrease in the amount of Zn from corrosion when KOH is used with mercuric oxide cells are also discussed. Author

N70-32647*# Idaho State Univ., Pocatello. Dept. of Chemistry.
INVESTIGATION OF ELECTRODE MATERIALS FOR ALKALINE BATTERIES Quarterly Report
G. Myron Arcand 25 Nov. 1969 25 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952265)
(NASA-CR-110756; QR-6) Avail: CFSTI CSCL 10C

The diffusion coefficient for the silver species in 9.94 VF KOH was found to be 2.75 + or - 0.000007 sq cm/sec at 25 + or - 0.1 C. Argentic oxide was found to decompose slowly at temperatures at least as low as 86 C and possibly lower. Both AgO and Ag2O can be activated to take up a substance or substances from the atmosphere at room temperature. Activation temperatures at least as low as 66 C are effective. No adsorption occurs without prior heating. The substances most likely to be adsorbed are water and oxygen. Weight increases after temperature activation exceed weight losses during heating. Amalgam electrodes in propylene carbonate and in dimethyl formamide do not show good high-rate discharge characteristics. In general, maximum discharge rates did not exceed 5 mA which would correspond to about 1 mA/cm sq. Lithium amalgams in LiClO4 produced open-circuit voltages around - 2.1 V vs the Hg/HgO electrode. Author

N70-32664*# Tyco Labs., Inc., Waltham, Mass.
ALUMINUM CHLORINE BATTERY Quarterly Report 27 Aug. - 26 Dec. 1969
Jose Giner and Gerhard L. Holleck 26 Dec. 1969 30 p refs
(Contract NAS12-688)
(NASA-CR-110712; QR-6) Avail: CFSTI CSCL 10C

The purification procedure for AlCl3, described earlier was modified by producing finely divided Al in situ in order to reduce the ionic iron content of the melt before evaporation of the AlCl3 Measurements of electrolyte conductivity were made in the ternary melt. The temperature dependence of the specific conductivity from 125 to 185 C in the AlCl3-KCl-NaCl melt (57.5-12.5-30 mol %) is demonstrated. The currents at the Al electrode were limited almost solely by mass transport, as was shown by studies at a rotating disk electrode. The electrode processes were further investigated by galvanostatic, current step methods. It was found that the charge transfer step at the Al electrode was quite fast, and that the observed overvoltages were mainly due to concentration polarization. The apparent exchange current, at 130 C was determined to be 268 mA/sq cm, and the average double layer capacity was found to be 40 microforads/sq cm. Author

N70-32748*# Tyco Labs., Inc., Waltham, Mass.
ALUMINUM CHLORINE BATTERY Quarterly Report, 27 Apr. - 26 Aug. 1969
Jose Giner and Gerhard L. Holleck 26 Aug. 1969 23 p refs
(Contract NAS12-688)
(NASA-CR-110713; QR-5) Avail: CFSTI CSCL 10C

Investigation of the behavior of the Al electrode in AlCl3-KCl-NaCl melts was continued. Experiments were conducted in quiescent electrolyte and at a rotating Al disk electrode. A special cell arrangement was used to allow microscopic, in situ

observation of the Al electrode during polarization. The results of these measurements confirmed earlier findings that the observed passivation of the Al electrode is caused by formation of a solid salt layer at the electrode surface resulting from concentration changes upon anodic or cathodic current flow. The cathodic behavior is further complicated by dendrite growth which causes the electrode to expand into the melt. It is evident that the values of the steady state current obtained are determined by diffusion processes and melt composition. Preliminary investigation of the AlCl3-KCl-NaCl phase diagram by differential thermal analysis showed that the melting temperature increases very rapidly when the AlCl3 content of the melt is increased from approximately 65 to 75 mol %. Author

N70-32764# Minnesota Mining and Mfg. Co., St. Paul, Minn. Electrical Products Group.

SNAP PROGRAM, PHASE 1. THERMOELECTRIC CONVERTER DEVELOPMENT PROGRAM Quarterly Report, 1 Oct. – 31 Dec. 1969

31 Jan. 1970 170 p refs

(Contract AT(30-1)-3824)

(MMM-3824-43; QR-12) Avail: CFSTI

During this quarter the design for all components and their associated drawings were completed for the top cover assembly of PMC-2. The PMC-2 converter proper which was assembled in the previous quarter was processed. During initial processing opens and shorts occurred which precipitated a failure analysis consisting of X-rays, partial disassembly, replacement of eleven couples and Min K-1301, rewelding and reprocessing. This effort was completed and PMC-2 is now ready for initial performance and stability testing. In addition to the failure of PMC-2, converter PMC-1B experienced an open after approximately one year of operation. A detailed analysis of these two failures which appear to be related is in progress. The cause for the failures appears to be copper contamination of the thermoelectric materials, but what initiated the reaction is unknown at the present time. Author (NSA)

N70-32771# Technische Univ., Berlin (West Germany). Inst. fuer Kerntechnik.

COMPARATIVE PERFORMANCE ANALYSIS OF LINEAR MPD GENERATORS

Gerhard Bartsch Sep. 1969 181 p refs In GERMAN

(TUBIK-15) Avail: AEC Depository Libraries

Different types of linear MPD generators are compared, considering power, efficiency, and load factors. Besides special operating conditions (i.e., maximum power or maximum efficiency operation) Hall effect, ion slip, and segmentation ratio are taken into account. These conditions are given separately and explicitly in calculations and diagrams. Thus, their influence on value and slope of parameters such as power and efficiency are distinct. Author (NSA)

N70-32778# Tennessee Univ., Tullahoma. Space Inst.

CURRENT DISTRIBUTION OF A SEGMENTED HALL GENERATOR

Y. C. L. Wu and J. F. Martin 13 Apr. 1970 25 p refs Presented at the 11th Symp. on Eng. Aspects of Magnetohydrodyn., Pasadena, Calif., 24-26 Mar. 1970

(Contract F44620-69-C-0031)

(AD-705180; AFOSR-70-1061TR) Avail: CFSTI CSCL 10/2

The paper describes an experimental and theoretical investigation of the current distribution in a segmented Hall generator with conductive side walls and insulating side walls respectively. The cathode emits in the arc mode; whereas the anode is an equi-potential. The current concentrates in the middle portion of the cathode and is very unsteady. The anode portion appears to be steady and the current spreads out somewhat evenly. The external load has little influence on the anode current distribution. In all load conditions, there is about 60% of the current flow into the anode, 15% flows to one side wall and 25% to the other side wall. The potential distribution on the anode side wall is linear and with a maximum potential drop of 40 volts. The cathode side wall appears to be an equi-potential surface. Author (TAB)

N70-32829*# Southwest Research Inst., San Antonio, Tex.

DEVELOPMENT OF BATTERY SEPARATOR MATERIAL PROCESS Final Report

L. M. Adams and W. W. Harlowe, Jr. Apr. 1970 246 p Prepared for JPL

(Contracts NAS7-100; JPL-951718; SwRI Proj. 01-2015-01)

(NASA-CR-110657) Avail: CFSTI CSCL 10C

Details are presented on the processing procedures and results. The following processes contributed to better sterilizable separator material: grafting polyethylene film with acrylic acid and then crosslinking with divinyl benzene; providing elevated temperatures and a nitrogen atmosphere over the grafting solution; using acetone, carbon disulfide, or sulfur as the chain terminator; cografting polyethylene film with mixtures of acrylic acid and hydrocarbon-type vinyl monomers; increasing the ratio of carbon tetrachloride to acrylic acid, decreasing the degree of grafting, and increasing the concentration of divinyl benzene; and using cotton cheesecloth as interlayer material in the grafting procedure. It was also found that aqueous acrylic acid and methacrylic acid solutions can be used for grafting, and polyethylene film can be cografted with acrylic acid in admixture with vinly monomers which will not graft polyethylene alone. An acceptable procedure for preparing large quantities of seperator material was developed, including a device for continuously neutralizing and washing the film. N.E.N.

N70-32837*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

FACTORS AFFECTING THE PERFORMANCE OF POROUS STRUCTURES USED AS OXYGEN FUEL CELL ELECTRODES

J. Katan Washington NASA Jun. 1970 163 p refs

(Contract NAS3-11833)

(NASA-CR-1623; N-3E-70-1) Avail: CFSTI CSCL 10B

Design methods are detailed for improving structures of oxygen electrodes. Prime emphasis is given to control of liquid distribution and configuration, best accomplished by using electrode structures which are well characterized. The critical role of a pendular-funicular transition state for correct internal liquid configuration is shown, together with its relation to design and performance. Experimental studies included a determination of synergistic effects with double-porosity structures and the necessity of catalyst placement toward the electrolyte side of the electrode. Gold was found to act suitably as an oxygen catalyst, and Teflon in the gas electrode acted as though imparting differential pressure to the system. Theoretical studies involved design recommendations for evaporating electrodes and the relation of structural parameters of porous systems. Author

N70-32866*# Catalyst Research Corp., Baltimore, Md.

DEVELOPMENT OF A LONG LIFE THERMAL CELL Final Report

J. R. Moser, R. L. Blucher, and D. Crouch 15 Nov. 1969 107 p

(Contract NAS3-10932)

(NASA-CR-72693) Avail: CFSTI CSCL 10B

Research development and testing of a long life thermal battery using a magnesium anode, cupric oxide cathode, a separator and fused eutectic salt, 59 mole % LiCl and 41 mole % KCl, operating at 427 C is presented. Component optimization and quality control characterization is determined to provide an easily constructed and high performance cell. The performance goal to provide a cell that would operate for 150 hours at 278 ma for 54 minutes and 833 ma for 6 minutes each hour while maintaining a low current voltage no less than 0.5 volts was achieved. E.M.C.

N70-32943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REVIEW OF SERT 2 POWER CONDITIONING

James W. Bagwell, Anthony C. Hoffman, Robert J. Leser, Karl F. Reader, John B. Stover et al [1970] 20 p refs Proposed for Presentation at the 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970; sponsored by AIAA

(NASA-TM-X-52858) Avail: CFSTI CSCL 10B

The SERT II power conditioning was required to meet severe operating conditions. These conditions include operation in vacuum, potential differences of 4000 volts, and frequent and unavoidable thruster arcs. Techniques intended to provide satisfactory, reliable performance for a period of at least six months are discussed. The techniques described include 'open-to-vacuum' construction of magnetic components, automatic overload protection, conformal coating, and aluminum coated insulating sheets as barriers. The performance of the successful power conditioning system to date is discussed. Author

N70-32986# Tennessee Univ., Tullahoma. Space Inst.

THE PERFORMANCE OF A FAMILY OF DIAGONAL CONDUCTING WALL MHD OPEN CYCLE GENERATORS

J. B. Dicks, Y. C. L. Wu, L. W. Crawford, J. K. Koester, J. W. Muehlhauser et al 13 Apr. 1970 16 p refs Presented at the 11th Symp. on Eng. Aspects of Magnetohydrodyn., Pasadena, Calif., 24-26 Mar. 1970

(Contract F44620-69-C-0031)

(AD-705159; AFOSR-70-1059TR) Avail: CFSTI CSCL 10/2

Experimental and theoretical studies were made of the performance of a 45 deg diagonal conducting wall generator and a Hall generator of the same physical dimensions. The wall temperature effect is investigated and an arc model is proposed. Aluminum was successfully burned in the combustor. It was found that the coating from burning of aluminum improves the channel performance due to the heating up of the walls. It was found that the fluctuations present in the Hall channel have much higher frequencies than those in the 45 deg DCW channel. The fluctuations grow along the channel in the Hall mode. The presence of the aluminum attenuates the fluctuations. The effect of the low conductivity nonuniformaties in the plasma and the coating of the wall has a very profound effect on the performance of the Hall generator. Author (TAB)

N70-33091*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A SCREENING AND SELECTION METHOD FOR NICKEL-CADMIUM CELL PLATES

Gerald Halpert Apr. 1970 20 p refs

(NASA-TM-X-63962; X-735-70-225) Avail: CFSTI CSCL 10A

A procedure has been developed for selection and screening of nickel cadmium cell materials to improve cell uniformity and reliability. The selection and screening by weight has been found to be a successful method for improving uniformity of plate capacity. A statistical analysis of the test results provides high weight-to-capacity correlations and a means of predicting plate capacity of every plate in a batch from weight alone. Author

N70-33196*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE DEGRADATION OF Cu2S-CdS THIN FILM SOLAR CELLS UNDER SIMULATED ORBITAL CONDITIONS

H. W. Brandhorst, Jr. and D. T. Bernatowicz [1970] 11 p refs Presented at the Intern. Colloq. on Solar Cells, Toulouse, France, 6–10 Jul. 1970; sponsored by the European Cooperation Space Environ. Comm.

(NASA-TM-X-52852) Avail: CFSTI CSCL 10A

Results of an investigation to determine the causes of variability and the cause of degradation itself are reported for the Cu2S-CdS thin film solar cells. Mechanical failure due to thermal stress was initially investigated but could not explain the results of the simulated space cycling tests. Rapid failure was subsequently observed when cells were illuminated while open-circuited. Progressive deterioration due to internal short circuiting was observed just as in some of the cycling tests. Filamentary conduction paths of copper coinciding with hotspots were found in the bulk of the cell. Various tests confirm the hypothesis that the filaments are the result of an electrochemical decomposition of Cu2S with a threshold voltage between 0.35 and 0.40 V. It is now believed that cells that degraded severely in early tests were operated near open-circuit voltage because of poorly selected load resistances. Results of current long-term tests in which the loads were carefully selected indicate a different, less severe mode of degradation also exists. Author

N70-33216# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.

CERTAIN PROBLEMS OF THE EFFICIENCY OF POWER PRODUCTION IN MHD GENERATORS WITH A NONEQUILIBRIUM PLASMA

V. V. Breev, A. V. Gubarev, and V. A. Gurashvili 1968 66 p refs In RUSSIAN

(IAE-1701) Avail: AEC Depository Libraries

There is serious doubt as to the future of such machines with the linear condition (Faraday) sectioned generator most thoroughly studied, since the efficiency of the station does not exceed 40% using currently feasible field inductions of approximately 10 tesla, a reactor pressure of > or = to 500 atm, and a gas temperature of < or = to 2000 K, which are the technical limits for the next decade. Even under the most optimistic assumptions (T approximately 2500 K, beta = 10 tesla, a high degree of heat regeneration, absence of thermal losses, etc.) for a reactor pressure of approximately 100 atm, a station efficiency of greater than 50% is achieved for a unit power of the MHD generator of > or = to 3 × 1,000,000 kW. The reason for such low efficiency is that the physical operating principles of the generator envisioned at the present time (ionization of the plasma, etc.) and the electrogasdynamic design of the generator make it impossible to obtain a high efficiency in the energy conversion process itself in the channel. NSA

N70-33300*# General Electric Co., Schenectady. Physical Chemistry Lab.

LOW TEMPERATURE BALLOON BATTERY, PHASE 2 Final Report, 22 Apr.–22 Nov. 1969

H. A. Catherino and W. N. Carson, Jr. Jan. 1970 36 p

(Contract NAS5-11556)

(NASA-CR-110695; S-70-1049) Avail: CFSTI CSCL 10C

The light-weight electrode substrates were investigated. Nickel screens fixed to a heat-sealable plastic backing were used with good results, and can make significant weight reduction in the system. Silver powder was found to be the key additive in the preparation of a rechargeable mercury electrode. The data suggest the silver has a triple function, i.e., a conductor, a mercury wettable interface, and a catalytic oxidant. The use of silver appears to be crucial for the construction of a rechargeable mercuric-oxide electrode. The result of the effort was a prototype cell one-quarter the size of that determined by the initial engineering estimates. The testing of this prototype cell made it clear that: the full-sized cell would meet the electrical requirements of the system; the aspect ratio (5 g/sq cm) can be easily met; the projected battery weight will be too high (i.e., 4320 grams). The case requirements will be easily met; and the battery life remains to be determined. Author

N70-33335# Institute of Nuclear Research, Warsaw (Poland).
HALL TYPE MHD GENERATORS WITH NONUNIFORM GAS PARAMETERS ALONG THE CHANNEL AXIS
Z. Celinski 1969 39 p refs
(INR-1107) Avail: AEC Depository Libraries

Expressions are derived which enable one to calculate the electrical parameters of the generator when the gas parameters vary along the generator channel. The comparison between the calculated electrical parameters in the case of uniform and nonuniform gas parameters was also performed. Author (NSA)

N70-33343* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERIAL CAPSULE EMERGENCY SEPARATION DEVICE Patent
Maxime A. Faget and Andre J. Meyer, Jr., inventors (to NASA) Issued 26 Sep. 1961 (Filed 16 Oct. 1959) 4 p Cl. 244-1
(NASA-Case-XLA-00115; US-Patent-3,001,739; US-Patent-Appl-SN-847027) Avail: US Patent Office CSCL 06G

This device relating to aerial emergency escape means, and particularly to an ejection configuration for detaching a space vehicle from its launching vehicle is described. The design of an improved aerodynamically stable and jettisonable tower for lifting an entire capsule clear of launching vehicle is given. J.A.M.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-32018# California Univ., Los Angeles. School of Public Health.
EFFECT OF HYPERBARIC OXYGEN-NITROGEN MIXTURES ON MICE Final Technical Report, 1 Mar. 1967–29 Jun. 1969
Harry Sobel 29 Jun. 1969 9 p refs
(Contract N00014-67-A-0111-0008)
(AD-703643) Avail: CFSTI CSCL 6/19

Mice were exposed to compression with 3 atm (rel.) of an air O2 mixture containing 27% O2 for 72 hr. They were injected with 1 microcurie of 14C-lysine at the initiation, 24 and 48 hr after compression was started. The cpm and sp act values of the protein of the carcass were determined. The sp act values were 10, 13, and 14% greater than that of the controls in the three groups. This appeared to be related to reduced food intake rather than any specific effect on nitrogen metabolism. Mice were exposed to 23 cycles each consisting of compression at 45 lb/sq in in an air-oxygen mixture containing 27% oxygen for 72 hr followed by 4 days of recovery. The skin was analyzed for salt-soluble, acid-soluble and insoluble collagen, hyaluronic acid, chondroitin sulfate, and fluorogenic material. Growth was less than that of the controls. There was 25% less salt-soluble collagen and 20% more fluorogenic material but the other values did not differ significantly from that on the basis of size. Acid-soluble collagen, extracted from the skins of newly-weaned mice, was exposed to 150 psi of oxygen for eight weeks. An increase in fluorescence at 360 mu activation/450 mu emission in collagenase digested collagen samples was observed after exposure. Author (TAB)

N70-32057*# Agence Tunisienne de Public-Relations, Tunis.
THE DIURNAL VARIATION OF METABOLIC PROCESSES AND OF BODY TEMPERATURE UNDER CONDITIONS OF FASTING AND COMPLETE MUSCLE REST [UEBER DIE TAGESSCHWANKUNGEN DES STOFFWECHSELS UND DER KORPERTEMPERATURE IN NUCHTERNAM ZUSTANDE UND VOLLSTANDIGER MUSKELRUHE]
J. E. Johansson Washington NASA Jul. 1970 74 p refs Transl. into ENGLISH from Skand. Arch. fuer Physiol. (East Germany), v. 8, 1898 p 85–142 Sponsored in part by NASA and NSF
(NASA-TT-F-12875; TT-70-58071) Avail: CFSTI CSCL 06P

Nineteenth century experiments on the metabolism and temperature of resting subjects are described, and critical evaluations are given. Emphasis is placed on exhaled carbon dioxide and the methods used to determine the amounts. The effects of food or fasting, muscular activity, body weight, and length of rest period were investigated. N.E.N.

N70-32062# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
ADAPTATION TO VESTIBULAR DISORIENTATION. 11: THE INFLUENCE OF SPECIFIC AND NON-SPECIFIC GRAVI-RECEPTORS ON NYSTAGMIC RESPONSES TO ANGULAR ACCELERATION
William E. Collins and Billy P. Updegraff Oct. 1969 17 p refs
(AD-704471; FAA-AM-69-20) Avail: CFSTI CSCL 6/19

Data from several recent experiments indicate that the otoliths (detectors of linear acceleration) may exert regulatory effects on responses of the semicircular canals (detectors of angular acceleration). This study was designed to explore further this notion. Horizontal ocular nystagmus from restrained birds was habituated in a directionally specific fashion by means of repeated angular accelerations. Substantial response recovery was evident following 2 weeks of rest. Vertical nystagmus was similarly habituated in a separate group of birds. The reduction of the latter response was obtained with the birds positioned so that vertical semicircular canals were in the plane of rotation. By changing the position of the birds 180 degrees after the habituation trials, the same set of canals could be stimulated but with the otoliths and other gravi-receptors oriented differently. Habituation was specific for the direction of nystagmus repeatedly elicited and for the head and body position maintained during habituation trials. A dynamic interaction between gravi-receptors and the semicircular canals is suggested as a possible feature of nystagmic habitation. Author (TAB)

N70-32063# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
RECOVERY OF MOTOR PERFORMANCE FOLLOWING STARTLE
Richard I. Thackray and R. Mark Touchstone Oct. 1969 18 p refs
(AD-704472; FAA-AM-69-21) Avail: CFSTI CSCL 6/19

Sudden, high-intensity sounds, such as those produced by sonic booms, can be quite startling. Although many studies have investigated physiological response to startle, much less is known concerning the effects of startle on performance. The present study was designed to provide further information concerning the extent to which startle disrupts performance, the rate of recovery, and characteristics of subjects (Ss) who differ in susceptibility to startle. Thirty Ss were trained on both reaction time and tracking tasks. Continuous recordings were taken of heart rate and skin conductance. During a subsequent period of continuous tracking, startle stimuli (115 db random noise) were unexpectedly presented. Results revealed the recovery of tracking performance following startle to be quite rapid; performance returned to pre-stimulus levels within 15 seconds following stimulation. Contrary to several previous studies, reaction times to the startle stimuli decreased relative to nonstartle reaction times. Ss with the greatest increase in tracking error following startle were least proficient prior to startle. There was also an indication that these Ss reacted more strongly to startle, both in terms of subjective response and heart rate acceleration, than those Ss whose tracking was least impaired by startle. An apparent covariation between recovery curves for heart rate and tracking error was found following startle. Author (TAB)

N70-32064# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
A COMPARISON OF THE BEHAVIORAL EFFECTS OF VARIOUS LEVELS OF CHRONIC DISULFOTON POISONING
David W. Pearson, George Clark, and Carl M. Moore Oct. 1969 11 p refs
(AD-704470; FAA-AM-69-19) Avail: CFSTI CSCL 6/20

Exposure of general aviation pilots to toxic pesticides has been reported as a possible cause of impairment of flying performance; in some instances it may have produced fatal results. Of particular concern and interest are the organophophates that are known to be AChE (acetylcholinesterase) inhibitors. It has been generally assumed that inhibition of the enzyme AChE in the central nervous system affects ACh (acetylcholine) destruction, a normal process which follows nerve impulse transmission at the synapse. Inhibition of AChE thus permits excessive accumulations of ACh which could possibly interfere with memory and/or learning processes. The present study explored the extent to which chronic cholinesterase inhibition in albino rats affects performance in a complex maze situation. The results indicate that disulfoton-exposed rats were capable of performing a maze-running task with fewer errors and shorter trial times than control animals, although AChE levels for the most severely exposed group were more than 75 percent below normal. The latter was attained by the animals on 50-p.p.m. of the poison. At this level an occasional animal had convulsions or severe tremors which temporarily incapacitated the rat. Author (TAB)

N70-32076# Joint Publications Research Service, Washington, D.C.
CERTAIN PROBLEMS IN STUDYING THE ORIENTATION OF BIRDS
V. D. Ilichev 8 Jun. 1970 11 p refs Transl. into ENGLISH from Biol. Nauki (USSR), no. 4, 1970 p 76–82
(JPRS-50681) Avail: CFSTI

A number of general propositions concerning the specific peculiarities of bird orientation, the integrity of orientation as a phenomenon, and the role of mutual contact in orientation are examined. These propositions are considered fundamentally important in a study of the detailed mechanisms of orientation. Author

N70-32105# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
THE DYNAMICS AND FLUID MECHANICS OF THE INTRA-AORTIC BALLOON HEART ASSIST DEVICE
T. A. McMahon, V. S. Murthy, C. Clark, M. Y. Jaffin, and A. H. Shapiro Dec. 1969 193 p refs
(Contract NIH PH-43-67-1114)
(DSR-70446; Publ-69-11) Avail: Issuing Activity

The technique of intra-aortic balloon pumping for assistance to the failing human circulation requires that a limp, gas-filled bag be introduced into the aorta. The bag is caused to inflate and deflate under the action of a pressure source outside the body via a small-bore tube. The volume displacements of blood achieved in this manner are designed to reduce the effort of the failing heart. A mathematical model of the arterial system, called the tapered elastic tube model, is developed consistant with physiologic input impedance measurements. In conjunction with a simple model of the balloon, the pressure-node, flow-source model, any two of the four variables heart pressure, heart flow, balloon pressure and balloon displacement flow may be predicted, given the remaining two. A principal conclusion is that the balloon should be both inflated and deflated during diastole, the period when the heart is not pumping, for maximum benefit to the heart. In experiments in a lumped-element hydraulic model of the arterial system, both the conventional limp balloon and a balloon design including longitudinal mechanical constraints were tested. Experiments simulated trials in both humans and dogs, for both liquid and gas inflation. The beamed balloon was found in every case to overcome a serious problem of limp balloon operation, which is that the balloon inflates to full extent locally and occludes the aorta before it reaches its full displacement volume, causing high heart pressures and poor performance of the device. Author

N70-32147# Royal Aircraft Establishment, Farnborough (England).
EFFECTS OF FORMS OF DIET OF DIFFERENT FAT CONTENT ON HUMAN ORGANISMS. 2: ENERGY METABOLISM AND PERFORMANCE ON THE ERGOMETER [AUSWIRKUNGEN VON KOSTFORMEN VERSCHIEDENEN FETTGEHALTES AUF DEN MENSCHICHEN ORGANISMUS. 2: ENERGIEUMSATZ UND LEISTUNGSFAHIGKEIT AM ERGOMETER]
A. Berghoff et al Jul. 1969 13 p refs Transl. into ENGLISH from Med. Pharmacol. Exptl. (Basel), v. 12, 1965 p 157–166
(RAE-Lib-Trans-1364) Avail: CFSTI

Energy metabolism and physical performance were tested in two subjects in twenty ergometric examinations over a long period, comparing the locally typical low-fat, high-carbohydrate diet with a high-fat, low-carbohydrate diet. Performance, as measured by pulse rate and maximum oxygen consumption during effort on the ergometer, is higher with a low-fat than with a high-fat diet. Fat is utilised as an energy source to a greater extent with a high-fat than with a low-fat diet. The BMR is lower with a low-fat than with a high-fat diet. The higher performance with a low-fat diet is not dependent upon an increased level of muscular effort. Energy metabolism and performance are adjusted to the level appropriate to a particular diet within a fortnight. For work requiring no ability to concentrate and coordinate (e.g. ergometric performance), A low-fat diet is more apt to improve performance. This does not necessarily mean that the same would be true for work requiring a high concentration and coordinating ability. Author

N70-32182# Texas Technological Coll., Lubbock.
THE EFFECT OF AUDIO-VISUAL ON VIBROTACTILE SIGNAL DETECTABILITY
Jerry D. Ramsey and Gary D. Luker (Boeing Co., Seattle, Wash.)
(Contract DAAD05-69-C-0102)
(AD-703869) Avail: CFSTI CSCL 6/16

With the design of more sophisticated and complex systems, the human operator is required to perform more tasks and to monitor more displays. Consequently, a greater burden has been placed on the visual and auditory sensory channels. To relieve this burden placed on the eyes and ears, it is suggested that other sensory channels be investigated to process some of the displayed information. Author (TAB)

N70-32207# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
GENERATION OF RANDOM SEQUENCES BY HUMAN SUBJECTS: A CRITICAL SURVEY OF LITERATURE
W. A. Wagenaar [1970] 16 p refs
(IZF-1970-K) Avail: CFSTI

The subjective concept of randomness is used in many areas of psychological research to explain a variety of experimental results. One method of studying randomness is to have Ss generate random series. Unfortunately, few results of the experiments that used this method lend themselves to comparison and synthesis because of the fact that the investigations employed such a variety of experimental conditions and definitions of mathematical randomness. Some suggestions for future research are made. Author

N70-32217*# Techtran Corp., Glen Burnie, Md.
FREQUENCY OF HEART CONTRACTIONS
In its Signals of Human Operator State Jun. 1970 p 141–172 refs (See N70-32212 17-05)
Avail: CFSTI CSCL 06P

The auto correlation functions of cardiac rhythm are analyzed.

and it is determined that after a steeply droping initial sector, this function fluctuates in a complex manner about the abscissa as pulse frequency varies with respiration and emotional state. An electrical analogue for vagus nerve inhibition is presented. Experimental modeling of the influence of emotional stress on cardiac contraction frequency by digital computer is described. Author

N70-32316# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

INFLUENCE OF GAMMA RAYS ON THE PRODUCTION AT BREAKS IN DNA [HET ONTSTAAN VAN BREUKEN IN DNA ONDER INVLOED VAN GAMMA STRALING]

G. P. van der Schans 1969 88 p refs In DUTCH; ENGLISH summary

(TDCK-54368) Avail: CFSTI

The average number of breaks per molecule for a population of DNA molecules was measured using the technique of sedimentation through a sucrose gradient in a preparative ultracentrifuge. Formulas are derived for the molecular weight distribution obtained after introducing random breaks in an initially monodisperse population of chain molecules. Quantitative data are presented along with details of methods and materials. It is shown that if random breaks are introduced into DNA molecules by means of gamma irradiation, the average number of breaks per molecule can be calculated from the sedimentation distance corresponding to the maximum of the distribution of broken DNA in the gradient. It is further demonstrated that in the case of indirect action double strand breaks arise from secondary reactions following radical attack on one strand. In this way a single strand break leads to a break in the complementary strand with an efficiency of about 2%. The same mechanism cannot be excluded for direct action. E.M.C.

N70-32350# Texas Technological Coll., Lubbock.

THE EFFECTS OF PRE-TASK ADAPTATION AND AVERSIVE STIMULATION UPON VIGILANCE BEHAVIOR

Douglas I. Blom and Charles G. Halcomb 11 Mar. 1970 30 p refs

(Contract DAAD05-69-C-0102)

(AD-703837) Avail: CFSTI CSCL 5/10

The complex problem of vigilance behavior has provided a sizable literature. Several theoretical models have been advanced to account for experimental findings. A hypothesis based upon aversive stimulation was presented, and data were collected to test the hypothesis. Specifically, the present study was designed to test the effects of pre-task adaptation and aversive stimulation upon the performance of a visual vigilance task. Author (TAB)

N70-32376# European Atomic Energy Community, Brussels (Belgium).

PROCEEDINGS OF THE SECOND SYMPOSIUM ON MICRODOSIMETRY

H. G. Ebert, ed. Jan. 1970 876 p refs Held at Stresa, Italy, 20-24 Oct. 1969

(EUR-4452-d-f-e) Avail: CFSTI HC$10.00/MF$0.65

Conference papers are presented on radiation measurements, radiation counters, relative biological effectiveness, and related topics on microdosimetry. For individual titles see N70-32377 through N70-32419. N.E.N.

N70-32377# Medical Research Council, London (England). Experimental Radiopathology Unit.

MECHANISMS OF LETHAL RADIATION DAMAGE TO CELLS

Tikvah Alper *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 5-49 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

Deoxyribonucleic acid is one of two important sites of primary lesion, and the nonnucleic acid target is the site at which radio-sensitization by oxygen occurs. Chemical protection, and sensitization in anoxic conditions, are also probably due to the effects of the agents concerned on the events following energy deposition in the nonnucleic acid site. There is now inferential evidence that cell membranes are the site of type O damage, though there may be subsequent interaction with the lesions following energy deposition in DNA. Observations on the killing of bacteria by neutrons and by particles of defined LET have led to the conclusion that increasing effectiveness, with increasing LET, is attributable to type O damage. It may be that the increase in effectiveness is due to an increase in the probability of interaction of type O and type N events, rather than to an increase in the probability of damage to the membrane itself. Author

N70-32378# Medical Research Council, Harwell (England). Radiobiology Unit.

THE INTERPRETATION OF SURVIVAL CURVES IN RELATION TO RADIATION QUALITY AND CELLULAR REPAIR MECHANISMS

G. J. Neary *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 51-81 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

The log-survival curves of bacteria and yeast have two obvious characteristics: the extent of the shoulder and the ultimate slope of the approximately linear later portion of the curve. There is some evidence that the shoulder and slope are partly determined by different mechanisms of repair. It is necessary to consider the distinction between the primary molecular lesions, the lesions remaining after completion of the swift metionic reactions, and the residual lesions after the intervention of postirradiation repair and bypass mechanisms. The effects of radiation quality and modifying agents such as oxygen appear to be different for these three classes of lesion. These ideas are illustrated with some new experimental data on DNA strand breakage in vitro and on cell killing. Data on the comparative effects of heavy particles and X-rays of low quantum energy show that the influence of radiation quality is complex and no simple index of quality is generally applicable. Author

N70-32379# Radiobiological Inst. TNO, Rijswijk (Netherlands).

LOCAL ENERGY DENSITY REQUIREMENTS FOR BIOLOGICAL RADIATION DAMAGE AND THEIR MODIFICATION BY ENVIRONMENTAL CONDITIONS

G. W. Barendsen *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 83-105 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

Characteristics of relations between the relative biological effectiveness of different ionizing radiations and the spatial distributions of energy dissipation in irradiated cells can be interpreted by the assumption that for the induction of various types of damage in cells, energy absorption is required at local energy densities which must exceed a minimum value. These high local energy densities initiate the chain of events which finally results in the end-point observed. A variety of factors is known to be capable of modifying the effectiveness of a given dose of ionizing radiation for producing biological damage. For radiations which mainly produce very high local energy densities, the effectiveness per unit dose for producing a given biological end-point is less dependent on various environmental conditions than the effectiveness of radiations which deposit most of the energy at low energy densities. The relation between the magnitude of the modification by oxygen and the variation in local energy density requirements is discussed. It is concluded that differences exist, depending on the end-point measured. Author

N70-32383# Radiobiological Inst. TNO, Rijswijk (Netherlands).
DISTRIBUTION OF ENERGY DEPOSITION BY GAMMA-RAYS AND 15 MEV NEUTRONS IN CYLINDRICAL VOLUMES
B. Hogeweg and G. W. Barendsen *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 171–181 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

Damage induced by ionizing radiations in biological systems is presumably caused by high local energy densities produced in one or more essential cellular structures of as yet unknown size and shape. In order to investigate the extent to which the shape of a structure is an important parameter with respect to the probability of the induction of damage by different radiations, measurements of event size spectra were performed with two cylindrical proportional counters with a central wire for which the ratios of length and diameter were 10 and 2 respectively. Irradiations were carried out with Co-60 gamma rays and 15 MeV neutrons produced by the D-T reaction. At a pressure of 1000 torr and 200 torr of tissue-equivalent gas no differences were observed between the event size distributions measured with the two counters but at a gas pressure of 100 torr significantly more large events were observed with the long counter irradiated with 15 MeV neutrons. At this pressure the diameter of the counter was equivalent to 0.5 micron of tissue. Author

N70-32384# Bureau International des Poids et Mesures, Sevres (France).
DISTRIBUTION OF DEPOSITED ENERGY BY NEUTRONS IN THE INTERIOR OF REVOLVING ELLIPSOIDS [DISTRIBUTION DE L'ENERGIE DEPOSEE PAR DES NEUTRONS A L'INTERIEUR D'ELLIPSOIDES DE REVOLUTION]
A. Allisy and M. Boutillon *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 183–192 ref In FRENCH (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

Calculations were made to determine the penetrating ability of neutrons in tissue equivalent materials. Conditions setup for the calculations required that the ellipsoid be placed in a homogeneous medium and under the influence of neutrons whose influence is uniform and isotropic. Other conditions required that the charged particles be rectilinear trajectories. Only the elastic diffusion of neutrons was considered. Transl. by J.M.C.

N70-32385# Hammersmith Hospital, London (England). Medical Physics Dept.
VARIATION OF RBE VALUES AND OER FOR COMPLEX HEAVY PARTICLE SPECTRA
J. F. Fowler *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 193–218 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

Predictions of relative biological efficiency (RBE) and oxygen enhancement ratio (OER) for beams of densely ionizing radiation, which would be useful for protection purposes and for machine design in radiotherapy, are reviewed. Extrapolation of these factors from limited measured values in certain biological specimens was attempted with moderate success. Some experiments, however, still give unexpected results. Nevertheless, semiquantitative explanations can be offered for the relative constancy of OER with neutron energy (except the high value at 0.42 MeV) and for the discrepancy in results of survival of human kidney cells in track-segment experiments with particles of high LET. One approach was through LET spectra, which are difficult to determine. The more direct approach through Y spectra are discussed. An example of an apparent discrepancy between biological results and expectations based on physical measurements occurred in the finding that the OER for fast neutrons changes significantly with depth in a tissue-equivalent phantom. Here the Y spectra appear to be more reliable than conventional physical methods. Author

N70-32403# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.
THE STOPPING POWER OF LOW ENERGY ELECTRONS IN BIOLOGICAL MATERIALS
M. Marshall, J. A. B. Gibson, and P. D. Holt *In* Euratom Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 529–539 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The target theory of Lea has been examined using modern data to determine whether consistent cross sections could be obtained from the inactivation of biological molecules by various radiations. The stopping power for low energy electrons and the rate of primary ionisation, which are required by the theory, are not known. However, when the theory is applied to the inactivation of the enzyme, ribonuclease, a consistent value of the cross section is found for one value of the parameter used to determine the primary ionisation and for one model of the stopping power for low energy electrons. In this work gamma rays, protons, deuterons and alpha particles were used to inactivate the ribonuclease. As much of the effect for heavily ionising radiation is due to delta rays, further experiments on the effect of low energy electrons (produced by low energy characteristic X-rays) are in progress. Preliminary results suggest that the models used are still valid. Author

N70-32411# Leeds Univ. (England). Dept. of Medical Physics.
TRACK STRUCTURE IN RELATION TO TARGET STRUCTURE
P. R. J. Burch *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 685–736 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

For certain classes of radiobiological change RBE stays independent of LET at low LET but declines at high LET. Accurate data for systems of this kind agree with the hypothesis that biological change results from a single random transfer of energy from the ionizing particle to a target zone. For some other types of damage—notably the induction of chromosome aberrations and the inactivation of the proliferative capacity of mammalian cells—RBE first increases with total LET to reach a maximum at around 100 keV/um and it then falls off at still higher LET. This relationship has been interpreted in terms of a multi-transfer mechanism. Previously, it has been supposed that at least n ion pairs have to be formed within a track segment t, and that the distribution of energy transfers within t is random. It will be argued that this model is unrealistic and that attention needs to be given to the structure of the target. The thermoluminescent yield from LiF exhibits LET-dependence. Author

N70-32413# European Atomic Energy Community, Ispra (Italy). Biology Div.
INTERPRETATION OF RADIOBIOLOGICAL EFFECTS WITH MICRODOSIMETRY
J. Booz *In its* Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 737–760 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The paper deals with the relation of survival curves and RBE-values to the spectral distribution of local energy density. Biological threshold and biological variance as well as recovery are taken into account. Using the inhibition of clone formation of human kidney cells as an example the paper discusses the extrapolation of RBE-values to very low doses and analyses the problem of the smallest target size which can be deduced from the measured RBE-curves. Author

N70-32414# Radiobiological Inst. TNO, Rijswijk (Netherlands).
THE RELATION BETWEEN MOUSE LETHALITY AND ENERGY DEPOSITION BY SECONDARY PARTICLES FROM NEUTRONS AND X-RAYS
J. J. Broerse, L. M. van Putten and G. W. Barendsen *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 761-778 refs (See N70-32376 17-04)
(Contract EURATOM-075-69-1 BION)
Avail: CFSTI HC$10.00/MF$0.65

The absorbed doses of fast neutrons and electromagnetic radiation depend on the atomic composition of the tissue in which energy is deposited. In previous experiments perturbations in secondary particle equilibrium for neutron- and X-irradiations have been measured at interfaces of bone- and soft tissue-equivalent plastic respectively and the results have been related to the RBE of 15 MeV neutrons compared to 300 kV X-rays for the induction of the bone marrow syndrome and the intestinal syndrome in mice. A major uncertainty in the interpretation of these studies arises from the fact that the RBE-LET relations may well differ for different types of cells. In order to evaluate such differences the spleen colony technique has been used to study the proliferation of haemopoietic cells in mice after irradiations with 15 MeV neutrons and 300 kV X-rays. RBE-values for the survival of colony forming units for both in vivo and in vitro irradiations have been compared with the RBE for the bone marrow syndrome. Author

N70-32415# Justus Liebig-Universitat, Giessen (West Germany).
SOME THEORETICAL CONSIDERATIONS CONCERNING ULTRA-HIGH DOSE RATE SURVIVAL EXPERIMENTS
Juergen Kiefer and Michael Ebert (Christie Hospital) *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 779-786 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

Theoretical expectations for specific effects of ultra-high dose rates on cell survival are considered: (1) primary damage to target molecules in the cell may be reduced due to recombination of radicals from different tracks. It is estimated that this effect is not likely to occur below doses of 280 Krad given at dose rates of 10 to the power of 14 rad/sec.; and (2) primary damage may be modified by secondary processes. On the basis of current models it is estimated that this might be seen at doses higher than 500 rad. Since the formation of long-lived secondary or tertiary radicals is essential, the exposure must be long enough to allow the respective reactions to take place. It is concluded, therefore, that there may exist an optimal dose rate where deviations from the effects at conventional dose rates may be found. Author

N70-32416# Kernforschungsanlage, Juelich (West Germany).
MICRODOSIMETRY OF IODINE-125 WITH REFERENCE TO THE AUGER EFFECT
H. H. Ertl and L. E. Feinendegen *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 787-800 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

I125 elicits the Auger effect. It is widely used as tracer of proteins and DNA (5-iodo-deoxyuridine). Comparing the radiation dosimetry for the case of tritium decay with that of I125 decay (considering the Auger electron emission), radiation effects from the latter are expected to exceed those from the tritium beta by a factor of approximately 3. First experimental data, however, indicate that I125 incorporated into DNA of mouse cells in vivo causes additional damage. Since effects from recoil and chemical transmutation are improbable causes for the additional damage observed, secondary effects due to fragmentation of multi-charged molecular ions in consequence of the Auger effect need being invoked for interpretation. Author

N70-32417# Gottingen Univ. (West Germany).
ELECTRON DEGRADATION AND BIOLOGICAL EFFECTS
B. Markus *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 801-812 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

After a short survey of the theoretical state practical ways of experimentally investigating the effect of the energy spectrum of fast electrons on biological reactions are described. Proof depends on suitable dosimetry and the choice of biological subjects and reactions. Criteria which are relatively independent of the dose and show qualitative differences in effect between various types of radiations proved especially suitable. In the experiments carried out with 14.2 MeV electrons the different energy spectra were obtained by varying the irradiation depth. The radiation effects observed were: (1) chromosomal aberrations in the tips of roots of Allium cepa (the onion): the relative frequency following irradiation displays a variation with the electron spectrum. It was shown by labelling with H3-thymidine that there is differing sensitivity to different electron spectra; and (2) in the various dose ranges the length-wise growth of the primary leaves of Hordeum (barley) displayed a stimulation effect. Author

N70-32418# Philipps-Universitat, Marburg (West Germany). Inst. fuer Strahlenbiologie und Medizinische Isotopenanwendung.
DEPTH DEPENDENCE OF LET SPECTRA FOR FAST NEUTRONS IN A HUMAN TRUNK PHANTOM [ETIEFENABHAENGIGKEIT DER LET-SPEKTREN FUER SCHNELLE NEUTRONEN IN EINEM MENSCHLICHEN RUMPFPHANTOM]
H. Krueger and E. H. Graul *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 813-840 refs In GERMAN; ENGLISH summary (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The LET spectra at various points in a human trunk phantom filled with tissue-equivalent solution were measured with a tissue-equivalent spherical proportional counter of 1 cm inside diameter. The primary neutron energies were 15 and 3 MeV respectively. The changes in LET with increasing depth within the phantom are given for these neutron energies and discussed, together with the depth/dose curves stemming from these measurements and the depth-dependent changes in the quality factor. Author

N70-32430# Armed Forces Radiobiology Research Inst., Bethesda, Md.
HEMATOPOIETIC RECOVERY IN IRRADIATED DOGS
S. J. Baum and D. E. Wyant Feb. 1970 30 p refs
(AD-703273; AFRRI-SR-70-2) Avail: CFSTI CSCL 6/18

The objectives of this study were to measure hematological recovery responses in the sublethally irradiated dog exposed to 150 rads of X-rays; and, furthermore, to compare these effects with those observed in animals irradiated with 150 rads of mixed gamma-neutron radiation. Finally, measurements of hematological recovery capabilities were to be obtained in previously irradiated dogs subjected to subsequent identical exposures after 3-month intervals. Author (TAB)

N70-32514# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPARATIVE CHARACTERISTIC OF SOME OF THE DEVICES USED TO DETERMINE THE MICROBIAL CONTAMINATION OF THE AIR
G. N. Ishchenko et al 16 Mar. 1970 9 p Transl. into ENGLISH from Med. Zh. Uzb. (Uzbek SSR), no. 6, 1962 p 16-18
(AD-705164; FTD-HT-23-144-70) Avail: CFSTI CSCL 6/13

The article deals with a comparative study between Krotov apparatus and plate culture methods of determining microbial

contamination of air. The air tested was that of schools and universities before and after classes. The results have been tabulated and comparison made. Author (TAB)

N70-32522*# National Aeronautics and Space Administration, Washington, D.C.
QUARANTINE SCHEMES FOR MANNED LUNAR MISSIONS
[1969] 13 p
(NASA-TM-X-64319) Avail: CFSTI CSCL 06F

The fundamental quarantine and sample release plans for manned lunar missions are presented. The scheme does not contain all possible finite technical details about quarantine test methods and containment provisions, but it provides the necessary framework for action and substantive methods for satisfying the quarantine requirements. It is impossible in any set of quarantine plans to anticipate every eventuality. Therefore, it is necessary that the schemes include a contingency provision that gives adequate opportunity to provide requirements and suggestions for situations not covered in the formal plans. In spite of efforts being made to assure aseptic collection and return of lunar samples, there is no certainty of the complete absence of earth microbial contaminants. And certainly, the potential of earth contaminants in returned lunar samples will be significantly greater after the first Apollo mission. Author

N70-32526# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
DAILY TOTAL-BODY EXPOSURES OF PRIMATES TO PROTON-, X-, OR GAMMA RADIATION: THE HEMATOLOGIC RESPONSE Final Report, Aug. 1967–Aug. 1969
David Sturrock, Edwin R. Ballinger, and Joseph E. Traynor Feb. 1970 70 p refs
(AD-705147; SAM-TR-70-1) Avail: CFSTI CSCL 6/18

In the course of space exploration, man may be exposed to relatively small but significant daily doses of high-energy proton radiation from solar flares. These doses might not be high enough to produce symptoms, but could produce changes in the number of peripheral blood cells. Rhesus monkeys were exposed in groups to daily, pulsed doses of 3-, 5-, 8-, 10-, 15-, or 20 rads from 150-Mev protons. Other groups were similarly exposed to pulsed 300-kvp X-rays. Still others were exposed continuously to cobalt-60 gamma radiation for a total dosage within 22 hours of 5-, 10-, 15-, or 20 rads. Assuming that the ratio of the dynamics of the changes in the peripheral blood counts from pulsed proton exposures (Pp) to those from pulsed X-rays (Px) would be the same as the ratio of the dynamics of the changes in the peripheral blood counts from continuous proton exposures (Cp) to those from continuous gamma exposures (Cg) (i.e., Pp:Px = Cp:(Cg), the unknown (Cp) could be deduced. Results suggest that the ratio Pp:Px is exceedingly close to unity, and that the ratio of Pp (or Px): Cg) is between 1.5 and 1.6 to 1. Consequently, the effect of continuous proton exposure within these daily dose increments can be predicted. Author (TAB)

N70-32527*# Minnesota Univ., Minneapolis. Space Science Center.
ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Progress Report, 1 Dec. 1967–31 May 1968
Jun. 1968 43 p refs
(Grant NGR-24-005-063)
(NASA-CR-97542) Avail: CFSTI CSCL 06M

A compilation of reports is presented describing research activity in the area of environmental microbiology as related to planetary quarantine. The reports include the following headings: (1) space hardware assay methodology; (2) die-off of microbial contamination; (3) effects of heat fixing and equilibration on B. subtilus var. niger spores; (4) methodology of measuring internal contamination of spacecraft hardware; (5) detection of low levels of microbial contamination on surfaces by chemical or bacteriological approaches; and (6) studies of attributes of mated surfaces that affect the heat destruction of microorganisms located in these areas. D.L.G.

N70-32534# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
QUANTIFYING HAZARDOUS MICROWAVE FIELDS: ANALYSIS
Paul F. Wacker Apr. 1970 23 p refs
(NBS-TN-391) Avail: SOD $0.30

The major hazard from microwave and lower frequency radiation is believed to arise from dielectric heating of body tissues, and the heating of an isotropic medium is proportional to the sum of the squares of the absolute values of the electric field components. Hence, electric field energy density is proposed for a radiation hazard standard. Analytical limitations of various types of probes are considered and the advantages of a spherically-symmetric probe of lossy dielectric are discussed. For a rather general spherically-symmetric probe in an arbitrary field, both exact and approximate treatments are given for the calibration constant with full correction for the perturbation of the field by the probe. Conditions for a constant factor are also given. Author

N70-32550 National Lending Library for Science and Technology, Boston Spa (England).
EQUIPMENT AND MATERIALS FOR THE TROPICS: DEVELOPMENT OF METHODS OF PROTECTION OF TRANSPARENT OPTICAL COMPONENTS FROM MOULD GROWTHS
A. I. Sviridova et al Jan. 1970 7 p refs Transl. into ENGLISH from Opt. Mekh. Prom. (Leningrad), No. 4, 1957 p 61–63
(NLL-RRE-Trans-258-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The protection from mold attack of transparent optical components of instruments used in the tropics was studied using methoxiethyl mercury acetate at various temperatures and relative humidities. It was found that mold did not grow for 9 to 11 months on glass surface treated with a solution of this acetate, and the presence of a hydrophobic silicon film does not prevent the fungicidal action. F.O.S.

N70-32573# Joint Publications Research Service, Washington, D.C.
CHARACTERISTICS OF BIOLOGICAL NOISE PROPAGATION IN SHALLOW WATER REGIONS OF THE BLACK SEA
Ye. V. Shishkova 9 Jun. 1970 9 p refs Transl. into ENGLISH from Rybn. Khozy. (Moscow), 1969 No. 9, p 37–39; no. 10, p 37–38
(JPRS-50691) Avail: CFSTI

The development of a biological noise direction method to hydroacoustically locate large, solitary fish was studied in the shallow waters of the Black Sea. Conclusions are: (1) The proper selection of receiving systems depths has a significant effect on the effectiveness of its operation. (2) At short ranges (100 to 200 meters) the maximum sound pressure occurs at the level of the source, beyond this distance, it shifts to the center of the water layer, regardless of the source depth. (3) The decrease in sound pressure occurs according to the cylindrical law. Graphs showing sound pressure as a function of range, depth, and temperature are included. F.O.S.

N70-32621# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
EFFECTS OF TWO COMMON MEDICATIONS ON COMPLEX PERFORMANCE

W. Dean Chiles, Harry L. Gibbons, and Paul W. Smith Jun. 1969 7 p ref
(AD-703631; FAA-AM-69-9) Avail: CFSTI CSCL 6/15

The performance of 10 subjects was measured over 4-hour periods following the administration of normal clinical dosages of Donnatal (two sessions), chlorpheniramine maleate (one session) and a placebo (one session) in a double blind experiment. Prior to the experiment, the subjects had been given extensive training on the battery of tasks used. The subjects were tested as two 5-man crews on the tasks which were designed to assess psychological functions of the kind involved in aircraft operations; included were measures of monitoring, information processing, visual discrimination and crew coordination. Although performance was in general numerically inferior under the chlorpheniramine maleate condition, no effects were found that could be statistically attributed to the drugs administered. Author (TAB)

N70-32740# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE INHALATION OF RADIOACTIVE SUBSTANCES. PART 3: URANIUM AND THORIUM (A LITERARY REVIEW)
F. Gensicke et al [1969] 21 p refs Transl. into ENGLISH from German report SZS-3/69
(Contract AT(29-2)-1013)
(LF-tr-1) Avail: CFSTI

On the basis of 128 references a brief summary is given of the metabolic behavior of uranium and thorium after inhalation. Elimination is considered in particular. Author (NSA)

N70-32789*# Oregon State Univ., Corvallis.
MICROORGANISM STUDY: BACTERIAL ISOLANTS FROM HARSH ENVIRONMENTS Final Report
W. B. Bollen and Karen M. Byers Kemper 22 May 1970 10 p Prepared for JPL
(Contracts NAS7-100; JPL-950783)
(NASA-CR-110558) Avail: CFSTI CSCL 06M

Identification data on soil isolants are tabulated. Source regions include the Antarctic, Alaska, Sahara Desert, Hilgard soils, California Desert, Chile, Hawaii, Little Lake, Oregon, Wyoming, Mexico, and Arizona. E.C.

N70-32861# Woods Hole Oceanographic Institution, Mass.
STRUCTURAL MOLECULAR BIOLOGY OF PHOSPHATES, PART 1
Johann Matheja and Egon T. Degens Jan. 1970 110 p refs
Avail: CFSTI

Four types of epitaxial growth processes are considered which can lead to formation of distinct structures and organic polymers. Boundary and surface phenomena of such processes are relevant to the study of mineralization processes in biological systems, prebiotic events leading to the origin of macromolecules, and operation principles in the genetic and metabolic apparatus. The tests show that the phosphate is a polyvalent anion and follows four structural formation principles which are additive in nature, but independent from each other. Because of the flexible building pattern governed mainly by ionic forces, it is concluded that phosphate units play an essential part in biocrystallographical structures in living systems. All four of the given structural formation principles can be observed as acting units in biochemical reactions. See also N70-32862. Author

N70-32862# Woods Hole Oceanographic Institution, Mass.
THE ROLE OF PHOSPHATES IN CELLULAR SYSTEMS, PART 2
Johann Matheja and Egon T. Degens Jan. 1970 113 p refs
Avail: CFSTI

Phosphorus is shown to have a distinct molecular relation to the common biogenic elements and PO4 units are shown to represent forces which introduce a crystallographical order at the molecular level in the cell. The structural composition and functional role of the biophosphates in cellular systems are discussed. The structure of water is discussed to formulate the dynamics of a cell. See also N70-32861. Author

N70-32885*# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Aerospace Medicine Dept.
DEVELOPMENT AND TEST OF FLEXIBLE FILM COUPON STRIPS FOR USE AS A SAMPLING TECHNIQUE Bimonthly Progress Report
C. Aldridge 10 Nov. 1968 29 p refs
(Contract NAS8-21443)
(NASA-CR-110764; BMPR-2) Avail: CFSTI CSCL 06M

The flexible film coupon method was compared with the stainless steel coupon method to improve the methodology for determining hardware microbiological contamination in clean room environments. The flexible film coupon assay technique is shown to be equal to or superior to the stainless steel method in tests with aerobic microorganisms. Under given conditions the flexible film coupon is useful as an adjunct to or can replace the stainless steel coupon. R.B.

N70-32898*# Research Triangle Inst., Durham, N.C.
NASA BIOMEDICAL APPLICATION TEAM PROGRAM: APPLICATIONS OF AEROSPACE TECHNOLOGY IN BIOLOGY AND MEDICINE Semiannual Report, Sep. 1969 - Mar. 1970
Mar. 1970 230 p refs
(Contract NASw-1950)
(NASA-CR-110645) Avail: CFSTI CSCL 06E

Details are given on the objectives and methodology of the Biomedical Application Team (BATeam) of scientists and engineers who act as an information and technology interface between NASA and individuals, institutions, and agencies involved in biomedical research and clinical medicine. Summary data are provided on the technology transfers, the problems investigated by the BATeam, and computer information searches. Among the significant transfers of technology reported is a new material for heart pacemaker electrodes developed from space antenna research, and use of computer correlation techniques in cardiovascular research. Author

N70-32900*# Naval Aerospace Medical Inst., Pensacola, Fla.
COMPARISON OF FIVE LEVELS OF MOTION SICKNESS SEVERITY AS THE BASIS FOR GRADING SUSCEPTIBILITY
Earl F. Miller, II and Ashton Graybiel 13 Feb. 1970 21 p refs
(NASA Order T-81633; NASA Order R-93)
(NASA-CR-110761; NAMI-1098) Avail: CFSTI CSCL 06S

The motion sickness susceptibility of 275 healthy male subjects was measured quantitatively by a standardized laboratory procedure using a Stille rotational chair. The results, in terms of velocity of the chair and the number of active head movements, were combined into a single numerical score that represented the total stressor stimulus sustained in reaching, in turn, each of five specific criteria for diagnosing the severity of motion sickness: viz. frank sickness(FS), severe malaise(M III), moderate malaise(M IIA and M IIB), and mild malaise (M I). The stressor value(E factor) of a single head movement at each test rpm was adjusted to yield an equivalent susceptibility score (Coriolis Sickness Susceptibility Index, or CSSI) independent of the endpoint selected. Close agreement among the CSSI scores obtained at each endpoint was found in intercorrelations, test-retest reliability coefficients, and frequency distributions, which reflected the orderliness and stability in the appearance, ramification, and intensification of the acute symptomatology evoked in progressing from M I to FS. The endpoint M IIA appeared, however, to yield the best balance between subject acceptability and test confidence and was used without exception to calibrate the motion sickness susceptibility of 250 additional subjects. Author

N70-33015# Rutgers Univ., New Brunswick, N.J. Dept. of Physiology.
CEREBRAL BLOOD FLOW DURING HYPERTHERMIA
Annual Progress Report, 1 Dec. 1968–31 Dec. 1969
Harry M. Frankel Jan. 1970 52 p refs
(Contract DA-49-193-MD-2423)
(AD-704357) Avail: CFSTI CSCL 6/16

The objective of this study is to determine at what elevated body temperature cerebral blood flow is adequate to meet the metabolic requirements of brain tissue. This report consists of a group of three papers titled: (1) Cerebrovascular Response During Progressive Hyperthermia in Dogs, (2) Cerebral Oxygenation and Metabolism During Progressive Hyperthermia, and (3) Cerebrovascular Response to CO2 in the Hyperthermic Dog. Author (TAB)

N70-33041# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
EFFECTS OF ALCOHOL ON COMPLEX PERFORMANCE
W. Dean Chiles and Alan E. Jennings Aug. 1969 13 p refs
(AD-703633; FAA-AM-69-14) Avail: CFSTI CSCL 5/10

Nine subjects were tested on a battery of tasks involving monitoring (simple reaction time, choice reaction time, and meter monitoring), two-dimensional compensatory tracking, and mental arithmetic. Three workloads were presented--monitoring plus tracking, monitoring plus arithmetic, and monitoring plus tracking plus arithmetic. The subjects ingested 2.5 ml. of an alcoholic beverage per kilogram of body weight two hours before testing; mean blood alcohol at the beginning of testing was 102 mg.%. Significant workload effects were found for three of the four measures of tracking performance, for simple reaction time, and for movement time in the choice reaction time task. Significant alcohol effects were found for reaction time in choice reactions, detection times for meter signals, and for three of the four measures of tracking. There was a significant interaction between workload and alcohol in the case of one tracking measure--RMS error in the vertical dimension. Nonsignificant RMS error in the vertical dimension. Nonsignificant (.10>P>.05) interactions were found between alcohol and workload for absolute error in both dimensions as well as for reaction time and movement time in the choice reaction time task. Author (TAB)

N70-33065*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RF RADIATION HAZARDS TO SPACE STATION PERSONNEL
R. A. Inman 20 May 1970 13 p refs
(NASA-TM-X-64523) Avail: CFSTI CSCL 06S

Although there is controversy concerning possible effects of exposure to microwave radiation, some harmful effects have been proven, such as formation of cataracts in the eyes. The proven effects alone justify precautions to insure that personnel are not exposed to harmful levels of RF radiation. Calculation of typical values of RF power density in the vicinity of space station antennas are included in this document. More definite calculations can be made when the system configurations have been more completely defined. However, the values calculated demonstrate that the currently accepted safe limits of RF radiation can be exceeded easily in the near field of high grain antennas on the space station. Personnel working in the field of these antennas should be protected from overexposure to this radiation. Author

N70-33102*# Library of Congress, Washington, D.C.
SOVIET SPACE BIOLOGY AND MEDICINE
David Wood and Elena Fortunatow Washington NASA Jul. 1970 402 p refs
(NASA Order W-12999)
(NASA-CR-1578) Avail: CFSTI CSCL 06B

A review of U.S.S.R. literature on space biology and medicine is presented. It consists of a commentary and 327 abstracts (divided into 12 topical sections), plus five additional references based on Soviet literature from October 1967 to February 1969. Reference numbers in the commentary cite the consecutively numbered abstacts or the additional references. Author

N70-33113*# Oak Ridge National Lab., Tenn. Biology Div.
BIOLOGY DIVISION NEUROSPORA EXPERIMENT P-1037 Final Report
Mar. 1970 31 p refs
(NASA Order W-12-792(04); NASA Order W-12-792(08))
(NASA-CR-73466; ORNL-TM-2912) Avail: CFSTI CSCL 06M

Successful experiments using Neurospora as the test organism were performed on two different space flights, the Gemini 11 mission and the Biosatellite 2 mission. In both experiments a study was made of the genetic effects of space flight alone and space flight in combination with known doses of radiation. On the Biosatellite 2 mission a Sr-85 gamma ray source was used; on the Gemini 11 mission a P-32 beta ray source was used. In both experiments a genetically marked two-component heterokaryon was used, heterozygous for two different genes that control sequential steps in purine biosynthesis. This strain was used to study radiation-induced inactivation of heterokaryotic conidia as well as radiation-induced gene mutation at two specific loci. In both experiments a range of radiation exposures were given, so that a comparison could be made between flight and ground-control dose-response curves rather than between flight and ground-control effects of some single exposure. In the Biosatellite 2 experiment, Neurospora conidia were tested while collected on the surface of millipore filters; in the Gemini 11 experiment they were tested both while collected on the surface of millipore filters and while in a colloidal suspension of agar. Author

N70-33116# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROBLEMS OF THE DYNAMICS OF SHELLS OF BLOOD CARRYING VESSELS
A. S. Volmir et al [1970] 7 p refs Transl. into ENGLISH from Mekhan. Polimerov (USSR), No. 2, 1970 p 373–379
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

Problems of the dynamic behavior of blood-carrying vessels are considered as deformable shells through which viscous fluids flow. A multilayer elastic shell in which an active, muscular layer is separated out is assumed as the model. Problems are discussed which can be solved by using the model. Author

N70-33191# Atomic Weapons Test Safety Committee (Australia).
STRONTIUM-90 IN THE AUSTRALIAN ENVIRONMENT DURING 1968
W. J. Gibbs, W. K. Matthews (UKAEA, Capehurst), J. R. Moroney, D. J. Stevens, and E. W. Titterton 1969 28 p refs
(NP-18100) Avail: AEC Depository Libraries

An Australia-wide survey of Sr-90 in global fallout was done, especially with reference to the passage of Sr-90 through food chains to human bone tissue. Results are presented for 1968, during which year the French exploded two nuclear devices in the megaton range in the South Pacific. The mean deposit of Sr-90 with rain and as dry fallout was the lowest for any year since monitoring began in 1958. Fallout from tests in Polynesia contributed significant fraction of the total Sr-90 deposit towards the end of 1968. The mean ratio of Sr-90/Ca in total diet for the year continued its downward trend. Results confirm that fallout over Australia from all nuclear weapons tests up to 1968 constitutes no significant hazard to the health of the Australian population now or in the future. NSA

N70-33204*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
RESEARCH ON LONG TERM BIOLOGICAL ISOLATION

OF PRIMATES AND MICE. VOLUME 1 Final Report, 7 Jan. 1969 - 7 Jan. 1970

Myron H. Bengson and T. D. Luckey (Missouri Univ.) 1970 160 p refs

(Contract NAS9-9000)

(NASA-CR-108548) Avail: CFSTI CSCL 06S

Classic Rhesus monkeys (Macaca mulatta) and a commercial monkey diet were used in the first part of the experiment and gnotobiotic mice and a comminuted Apollo diet were used in the second part. After six months of bio-isolation in a gnotobiotic isolator, the number of intestinal microflora of Macaca mulatta shifted. Escherichia coli dropped in numbers, while in control animals the shift was much slower or did not occur at all. Indigeneous Lactobacilli began to disappear while other microorganisms increased in number. The results indicate that deleterious changes in the immunity mechanisms, potential pathogen runaway, and loss of the benefits of a protective mixture of microflora may occur during prolonged space flight. Similar results were noted in experiments with mice. R.B.

N70-33205*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

RESEARCH ON LONG TERM BIOLOGICAL ISOLATION OF PRIMATES AND MICE. VOLUME 2: APPENDICES

Myron H. Bengson and T. D. Luckey [1970] 131 p refs

(Contract NAS9-9000)

(NASA-CR-108549) Avail: CFSTI CSCL 06S

Photographic and tabular data are presented on biological isolation experiments with monkeys and mice. The data include hematology, diet preparation, microbiological information, and operating procedures for conducting the experiments. R.B.

N70-33206*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

RESEARCH ON LONG TERM BIOLOGICAL ISOLATION OF PRIMATES AND MICE. VOLUME 3: STANDING OPERATING PROCEDURES FOR PRIMATE ISOLATION STUDY APPENDIX J Final Report

M. H. Bengson and T. D. Luckey [1970] 116 p

(Contract NAS9-9000)

(NASA-CR-108550) Avail: CFSTI CSCL 06S

Operating guidelines are presented for use in biological isolation experiments with primates. The checklists and procedural guidelines were written to direct the performance of routine procedures and guidelines are included for future experimentation. Author

N70-33207*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

RESEARCH ON LONG TERM BIOLOGICAL ISOLATION OF PRIMATES AND MICE. VOLUME 4: THE LITERATURE SEARCH, APPENDIX M Final Report

M. H. Bengson and T. D. Luckey [1970] 129 p refs

(Contract NAS9-9000)

(NASA-CR-108551) Avail: CFSTI CSCL 06S

The results of a literature search for the effects of microflora on host organisms, with emphasis on intestinal microflora, are presented. The bibliography was used in research on the long term effects of biological isolation on primates and mice. R.B.

N70-33359# Commissariat a l'Energie Atomique, La Hague (France).

EXPERIMENTAL AND IN SITU CONTAMINATIONS OF AQUATIC ENVIRONMENT BY RU 106

J. Ancellin and P. Bovard 1969 8 p refs In FRENCH Presented at the 4th Intern. Colloq. on Med. Oceanography, Naples, 2-5 Oct. 1969

(CEA-Conf-1464; Conf-691031-1) Avail: AEC Depository Libraries

Experimental contaminations of algae and marine invertebrates with soluble or insoluble Ru106 showed that the former leads to concentration factors lower than the latter (by a factor of five up to 10). The high values obtained for the concentration factors in the natural environment where the radioactive wastes are disposed can often be compared to those obtained experimentally. Author (NSA)

N70-33379# Joint Publications Research Service, Washington, D.C.

ORIENTATION OF BIRDS

A. B. Kistikovskiy et al 18 Jun. 1970 9 p refs Transl. into ENGLISH from Priroda (Moscow), no. 1, Jan. 1970 p 56 - 61

(JPRS-50767) Avail: CFSTI

Radiolocation observations of birds during variable weather conditions are presented; boundaries were also determined for orientation capabilities. Homing speeds during clear and overcast weather are compared. Studies are continuing on the homing mechanism of birds in planetariums and in the field. J.A.M.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-32013# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

APPLICATION OF OPTIMAL CONTROL THEORY TO THE PREDICTION OF HUMAN PERFORMANCE IN A COMPLEX TASK Final Report, Jan. 1968 - Jan. 1969

Sheldon Baron, Jerome I. Elkind, David L. Kleinman, Duncan C. Miller, and William H. Levison Mar. 1970 159 p refs

(Contract F33615-68-C-1192)

(AD-704562; BBN-1776; AFFDL-TR-69-81) Avail: CFSTI CSCL 5/10

A procedure is developed for using human response theory and the analytic methods of optimal control theory to analyze a complex manual control task. The central element in the procedures is a model of the human operator that is based on the assumption that well-trained operators perform optimally subject to certain inherent limitations. Recent results in human response theory provide the representation of the humans limitations. Optimal control theory is then used to predict closed-loop human and system performance. The manual control of the longitudinal position of a hovering VTOL vehicle is analyzed using the developed techniques. Author (TAB)

N70-32021# Bio-Dynamics, Inc., Cambridge, Mass.

THE APPLICATION OF MOIRE FRINGE EFFECTS TO VISUAL INSTRUMENTATION Final Report

Paul Weene 28 Feb. 1970 154 p refs

(Contract N00014-68-C-0363)

(AD-704902) Avail: CFSTI CSCL 5/5

The study was performed to investigate the feasibility of utilizing Moire fringe effects (MFE) in instruments intended for human observers. The first phase of the project began with the development of adequate definitions for Moire fringe effects and their components, followed by an attempt to classify Moire effects. An extensive series of pilot studies followed, performed to explore some qualitative and quantitative properties of MFE and to describe limitations to Moire displays. The findings were interpreted in terms of instrument considerations and applications, and resulted in recommendations for the utilization of MFE. Phase II of the study was concerned with the design and construction of instruments

incorporating Moire fringe effects and with practical considerations involved in their manufacture. The range potential applications of the MFE phenomena was investigated and several representative instruments were selected. The designs for these instruments were than developed and prototypes constructed. Author (TAB)

N70-32023# Lockheed Missiles and Space Co., Sunnyvale, Calif.
VISUAL SIGNAL DETECTION AS A FUNCTION OF THE SPATIAL DISTRIBUTION AND THE SIZE OF DISPLAYED ELEMENTS
B. B. Brandaliss, E. H. Sasaki, S. Seidenstein, and G. L. Kreezer
15 Apr. 1970 77 p refs
(Contract N00014-69-C-0204)
(AD-704497; LMSC/A-969714) Avail: CFSTI CSCL 6/16

The report describes several experiments which investigated the luminance thresholds for signal recognition as a function of the spatial frequency and size of displayed elements on a television monitor. These factors were varied to simulate the perceptual conditions that occur when line scan displays are viewed at slant angles to enhance signal recognition. Several exploratory studies were conducted to determine if viewing the line scan display at a slant angle and if providing a dynamic control of the raster size enhanced signal recognition. Author (TAB)

N70-32033*# Miami Valley Hospital, Dayton, Ohio. Dept. of Research.
THE EFFECT OF CABIN TEMPERATURE ON THE NUTRITIONAL, BIOCHEMICAL AND PHYSIOLOGICAL PARAMETERS OF MAN IN A LIFE SUPPORT SYSTEMS EVALUATOR
Bernard J. Katchman, James P. F. Murphy, Carol A. Linder, and Vickie R. Must
(NASA Order R-85; Contract AF 33(657)-11717)
(NASA-CR-110511; AD-701752; AMRL-TR-67-107) Avail: CFSTI CSCL 06K

Four human male subjects were confined for 6 weeks of which 35 consecutive days were spent in a Life Support Systems Evaluator. During this period the environmental temperature in the Evaluator was cycled from 23C to 32C on a weekly schedule. The subjects ate a one-cycle diet of fresh foods that provided 92g protein, 91g fat, 343g carbohydrate, and 2500 kcal of metabolizable energy. The diet was rated 6 on a 9-point scale or like slightly in acceptability. There was a definite decrease in acceptability with time but there was no difference in acceptability at the two temperatures. The diet was sufficient to maintain a 67 kg man without weight loss. Digestibility of food was high; there was no temperature effect. The clinical data, hematology, blood chemistry, blood pressure, oral temperature, and heart rate were all in the normal range. The subjects maintained good health throughout the experiment. Author (TAB)

N70-32081# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
MAN-MACHINE SYSTEMS GROUP Annual Report, 1969
A. van Lunteren and H. G. Stassen Apr. 1970 106 p refs
(WTHD-21) Avail: CFSTI CSCL 5/8

A study of information exchange within man-machine systems is reported. In particular, the interests were focused on mathematical descriptions of the behavior of a man controlling a technological process. Test set-ups are described along with experimentation conducted, methodology utilized, and results obtained. Various aspects of the study include: (1) A bicycle simulator was developed to study the stabilization process as well as the course following process of a bicycle rider. In addition, the influence of different drugs on the behavior of the human operator were studied. (2) A test set-up was perfected to evaluate the effectiveness of various means of transmitting information to the human operator by tactile stimulation of the skin, and a comparison was made between tactile, visual, and auditive stimulation. (3) A set-up was developed to study EEG signals of a subject exchanging information with a technical system. Two types of experiments were executed; the first dealing with skin stimulation perception; the second dealing with the brain activities of a subject linked up in a control system. (4) A study on decision problems was initiated. D.L.G.

N70-32212*# Techtran Corp., Glen Burnie, Md.
SIGNALS OF HUMAN OPERATOR STATE
A. N. Lukyanov et al Washington NASA Jun. 1970 274 p refs Transl. into ENGLISH of the book "Signaly Sostoyaniya Cheloveka Operatora" Moscow, Nauka Press, 1969 p 1–235
(Contract NASw-1695)
(NASA-TT-F-609) Avail: CFSTI CSCL 06D

CONTENTS:

1. THE HUMAN OPERATOR IN THE CONTROL SYSTEM p 1–9 refs (See N70-32213 17-05)
2. EXPERIMENTAL METHODOLOGY p 10–21 refs (See N70-32214 17-05)
3. SIGNALS OF THE STATE OF ATTENTION p 22–89 refs (See N70-32215 17-05)
4. THE ELECTROENCEPHALOGRAM p 90–140 refs (See N70-32216 17-05)
5. FREQUENCY OF HEART CONTRACTIONS p 141–172 refs (See N70-32217 17-04)
6. THE SPEECH SIGNAL p 173–215 refs (See N70-32218 17-05)

N70-32213*# Techtran Corp., Glen Burnie, Md.
THE HUMAN OPERATOR IN THE CONTROL SYSTEM
In its Signals of Human Operator State Jun. 1970 p 1–9 refs (See N70-32212 17-05)
Avail: CFSTI CSCL 06D

This chapter presents a broad overview of the problem of reliability of the human operator in the control system. It is pointed out that human operator reliability is maximal only at a certain level of operator stress, and that stress levels either too low or too high result in a decrease of operator reliability and performance. Various methods of analyzing man-machine systems, looking upon the operator as the controlling or the controlled element, are briefly analyzed. Author

N70-32214*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL METHODOLOGY
In its Signals of Human Operator State Jun. 1970 p 10–21 refs (See N70-32212 17-05)
Avail: CFSTI CSCL 06D

Four series of experiments are described which were undertaken to analyze the influence of emotionality and stress on operator efficiency. The experiments included: (1) reception of a light signal, with the response being to press a button immediately upon receipt of the signal, thereby testing attention stability; (2) selection of an audible signal, consisting of a series of numbers in which the test subject was to recognize when a number was being repeated; (3) search for a visual signal, involving recognition of and counting of certain types of patterns on a pattern filled screen; and (4) electron beam control, in which an electron beam was to be made to match a curve on an oscilloscope by manual control. Author

N70-32215*# Techtran Corp., Glen Burnie, Md.
SIGNALS OF THE STATE OF ATTENTION
In its Signals of Human Operator State Jun. 1970 p 22–89 refs (See N70-32212 17-05)
Avail: CFSTI CSCL 06D

Various types of signals of the state of attention are analyzed. The signals analyzed include the alpha rhythm and other electroencephalographic characteristics. The values of a random sequence of readings of the alpha rhythm integrator are subjected to mathematical analysis to determine distribution, confidence limits, etc. Author

N70-32216*# Techtran Corp., Glen Burnie, Md.
THE ELECTROENCEPHALOGRAM
In its Signals of Human Operator State Jun. 1970 p 90–140 refs (See N70-32212 17-05)
Avail: CFSTI CSCL 06D

A general analysis of the electroencephalogram is presented. The various rhythms encountered in the electoencephalogram are described and characterized statistically. Variations in the typical electroencephalogram with variations in the state of attention are described. Typically EEG integrator output signal are analyzed mathematically. Author

N70-32218*# Techtran Corp., Glen Burnie, Md.
THE SPEECH SIGNAL
In its Signals of Human Operator State Jun. 1970 p 173–215 refs (See N70-32212 17-05)
Avail: CFSTI CSCL 06D

Experiments indicate that the changes in the spectral conditions of a speech signal are among the most reliable for determination of the emotional state of a human operator. Experiments performed included modeling human speech under the influence of emotion, which confirm the stable changes in frequency composition, etc. with emotional coloring. Author

N70-32258# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
HUMAN ASPECTS OF SHIP MANOEUVRING AND SIMULATION
W. A. Wagenaar 1969 10 p
(IZF-1969-26; TDCK-54651) Avail: CFSTI

The maneuverability of a ship is determined by the physical properties of the ship in its environment and the physiological and phychological characteristics of its navigator. The study of maneuverability emphasized the interactional aspect. Human perception, information processing, adaptation, and training are discussed briefly. It is proposed that research and adequate training in this field are only possible if the situation for the man on the bridge is simulated as realistically as possible. Author

N70-32351# Texas Technological Univ., Lubbock.
A STEREOMETRIC SYSTEM FOR MEASURING HUMAN MOTION
M. A. Ayoub, M. M. Ayoub, and J. D. Ramsey 1970 41 p refs
(Contract DAAD05-69-C-0102)
(AD-703873) Avail: CFSTI CSCL 5/5

The primary objective of the investigation was to develop a system for measuring human motion in three dimensions, utilizing principles and methodology of stereophotogrammetry. The study had two phases. The first included basic theoretical and laboratory investigations of the various parameters which influence the design and construction of a stereometric system. In the second, the system was evaluated during an experimental investigation in which an attempt was made to test its accuracy and adequacy in measuring objects under static and dynamic orientations. In further experimentation, the stereometric system was used to determine the motion characteristics for human subjects under three-dimensional moves. Author (TAB)

N70-32352# Texas Technological Univ., Lubbock. Center of Biotechnology Fatigue and Human Performance.
MEMORY LOAD AND INFORMATION CODING IN CONCEPT LEARNING
Nathan R. Denny and T. Garrett 1969 14 p refs Presented at the Western Psychological Assoc. Meeting, Vancouver, Can., 19 Jun. 1969
(Contract DAAD05-69-C-0102)
(AD-703867) Avail: CFSTI CSCL 5/10

An investigation was made of the effects of different methods of solution on solution efficiency and memory error. The three methods used varied the kind of perceptual assistance Ss used. These methods also varied the availability of previously presented stimuli. The three methods of solution for the two rules of inclusive and exclusive disjunction were studied under conditions of temporal stress, with all methods using a 30 second interval between the onsets of successive stimuli. In solving the attribute identification problems, Ss used a method involving the use of either no memory aid, or a cumulative record of S hypothesis notations, or a display allowing them to view the last 10 stimuli between trials. Author (TAB)

N70-32357*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE EVALUATION OF AN EVAPORATIVE WATER-RECOVERY SUBSYSTEM UTILIZING AN AUTOMATIC FEED CONTROL
John B. Hall, Jr. Washington Jul. 1970 31 p refs
(NASA-TM-X-2042; L-7048) Avail: CFSTI CSCL 06K

A performance evaluation has been conducted of an evaporative water recovery subsystem designed to recover potable water from liquid wastes on long duration manned space missions. The evaluation included four wick-life tests over a range of operating conditions. Process rates of 0.60 to 2.60 lb/hr (0.272 to 1.180 kg/hr) were obtained for various combinations of evaporator air-inlet temperature, condenser air-outlet temperature, and a subsystem average air-flow rate of approximately 37 cu ft/min (1.048 cu m/min). A total of 729.6 pounds (331 kilograms) of urine and flush water was processed with a recovery efficiency of virtually 100 percent. The effects of urine collection and pretreatment on the quality of the recovered water were evaluated, and the degradation in subsystem performance with urine-solid buildup in the wicks was determined. Maximum wick life as determined by the capacity of the wick to retain urine solids was 36 days/man/pound of wick material (79 days/man/kilogram of wick material) for the urine and flush water processed. The feasibility of utilizing an automatic control for batch feeding liquid wastes into the evaporator to minimize crew attention to the subsystem was demonstrated. Author

N70-32360# St. Louis Univ., Mo. Parks Coll. of Aeronautical Technology.
A STUDY OF THE EFFECT OF TIME ON THE INSTRUMENT SKILL OF THE PRIVATE AND COMMERCIAL PILOT Final Report
Leon Z. Seltzer 38 p refs
(Contract DOT FA-69-WA-2202)
(FAA-DS-70-12) Avail: Issuing Activity

This study was performed to determine the effect of time on the instrument skill of non-instrument rated private and commercial pilots. Sixty-six private and commercial pilots who have had their licenses from 6 months to 9 years were used as subjects. Results show that there is an apparent decline in instrument proficiency with time for the private pilot and to a lesser degree for the commercial pilot. This proficiency can be regained. During the project this was accomplished with an average of 2-1/2 hours flight instruction plus 50 minutes ground instruction for the private

pilots and 1-1/2 hours flight instruction plus 25 minutes ground instruction for the commercial pilots. The average improvement for private pilots, as a result of flight and ground instruction, was 33% and for the commercial pilot, 29%, over their initial check score. Author

N70-32440# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENTAL INVESTIGATION OF THE DEPENDENCE OF THE PROBABILITY OF IMAGE RECOGNITION
N. W. Krasilinkov et al 5 Mar. 1970 8 p Transl. into ENGLISH from Tekhnika Kino i Televideniya (Moscow), no. 2, 1969 p 53–54
(AD-704768; FTD-MT-24-347-69) Avail: CFSTI CSCL 5/5

Outlined are the results of experimental dependence investigation of the probability of the correct image identification, transmitted by the system, from the number of images included into the initial category. TAB

N70-32473*# Applied Electrochemistry, Inc., Mountain View, Calif.
DEVELOPMENT OF A CO2-H2O SOLID OXIDE ELECTROLYTE ELECTROLYSIS SYSTEM Annual Report
J. Weissbart and W. H. Smart May 1970 104 p refs
(Contract NAS2-4843)
(NASA-CR-73464; AR-2) Avail: CFSTI CSCL 06K

Development of an aerospace life support system for oxygen production from CO2 proceeded successfully from the 12-ampere to the 127-ampere level during this program period. The system consisting of a 127-ampere three-module CO2-H2O solid oxide electrolyte electrolyzer at 880 C and CO-disproportionation reactor at 556 C was tested and operated continuously beyond 250 hours. The unit generated oxygen at a rate of 481 ml/min with a faradaic current efficiency near 100% and an average CO2 content of only 2.4%. The CO2 was converted in the electrolyzer to 53% CO, and one-third of this CO was disproportionated in the reactor to carbon and CO2. Each module, rated at 48 amperes and operated at 42 amperes at a current density of 175 mA/sq cm, contained twelve cells arranged as six two-cell drums. Author

N70-32482# School of Aerospace Medicine, Brooks AFB, Tex.
A PORTABLE, SELF-POWERED SYSTEM FOR RAPID DETERMINATION OF BLOOD pH AND HEMATOCRIT, AND LEVELS OF SODIUM, POTASSIUM, AND CHLORIDE Final Report, Dec. 1966–May 1969
Marion J. Stansell and Shelby J. Stansell Dec. 1969 39 p refs
(AD-705169; SAM-TR-69-78) Avail: CFSTI CSCL 6/12

A rapid, reliable, and accurate system has been developed for measuring blood hematocrit, blood pH, plasma chloride, plasma sodium, and plasma potassium levels during aeromedical evacuation operations. This analytic system, which has been subjected to extensive laboratory tests, is not only compact, portable, completely self-contained, and battery operated, but uses only small quantities of sample. With this assembly, the entire analytic operation from blood collection to final readout can be accomplished in 7 min. Validation testing indicates: (a) excellent electronic and temperature stability; (b) freedom from extraneous electrical interference; (c) a procedural coefficient of variation of less than 1% for measurements of pH and levels of sodium and chloride, near 1.4% for determination of hematocrit, and near 3% for the measurement of potassium; (d) agreement within 2% with established reference methods; and (e) six months of daily operations without debilitating malfunction. The system is of potential value in aeromedical evacuation as well as in emergency field hospitals, hospital wards, and any other areas requiring a system which is portable and independent of gas supplies and external electric power. Author (TAB)

N70-32483# Naval Postgraduate School, Monterey, Calif.
COMPUTERIZED SURVIVOR SEARCH PLANNING
Joseph Henry Discenza (M.S. Thesis) Jun. 1969 117 p refs
(AD-704781) Avail: CFSTI CSCL 6/7

A computer program is presented which solves the search planning problem for survivors at sea. The program is designed to utilize weather data. An investigation is also made into the search criteria used by the United States Coast Guard in its planning procedures. Guidelines are given for the use of the square search and the Sector search. Author (TAB)

N70-32513# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF A LEARNING RECOGNITION SYSTEM FOR THE SEPARATION OF AN UNKNOWN SIGNAL FROM NOISE
A. Kh. Gelig et al 12 Mar. 1970 12 p refs Transl. into ENGLISH from Vychislitelnaya Tekhn. i Vopr. Programmirovaniya (USSR), v. 7, no. 5, 1968 p 95–100
(AD-705156; FTD-HT-23-80-70) Avail: CFSTI CSCL 6/4

An experiment in the detection of a signal (with its form not given in advance) in the presence of great noise with the aid of a learning recognition system (L-optimal recognition system) is described. Pictures composed of a random accumulation of points appear on a 10 x 10 cm screen. The number of points varies from 20 to 40. Each picture belongs to one of two classes. The picture belonging to the first class contains a signal in the form of a rhomb of eight points. The dimensions of the rhomb in all pictures of the first class are the same, only their locations and orientations change. The pictures of the second class are not rhombs and imitate the noise without a signal. The figures of the first class imitate the signals in the presence of such a great noise that when the form of the signal is submitted to a man he makes a 5 percent error in recognizing it when the time of recognition is limited to 2-3 sec. During the experiment the form and the character of the signal is not submitted to the recognition system or to a man, and only the pictures of both classes (instruction sequence), indicating to which class they belong are shown. TAB

N70-32555# Technical Communications Corp., Los Angeles, Calif.
TOP-MAN X: A MANAGEMENT SIMULATION FOR INSTRUCTION IN TOTAL PROGRAMMING AND THE BASE ENGINEER AUTOMATED MANAGEMENT SYSTEM (BEAMS) Final Report, Sep. 1967–Sep. 1969
Joel M. Kibbee, Leon Vickman, Ellen M. Dent, Luis F. Dominguez (AFSC, Wright-Patterson AFB, Ohio), and Arthur T. Stellmach (AFSC, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFSC 26 Sep. 1969 62 p refs
(Contract F33615-68-C-1076)
(AD-704892; SFN-2643; AFHRL-TR-69-20) Avail: CFSTI CSCL 5/9

TOP-MAN-X, a management game is used to assist in the instruction of USAF personnel in Total Programming. Total Programming is a USAF developed set of concepts and procedures for the optimum allocation of resources to the operation and maintenance of real property facilities on an Air Force base. TOP-MAN-X is a manual suitcase management game. The report includes a short introduction to Total Programming, a discussion of TOP-MAN-X and the various steps in its development, and concludes with some remarks on the automation of both TOP-MAN-X and Total Programming. Author (TAB)

N70-32594*# Matrix Corp., Alexandria, Va. Human Factors Div.
SELECTION OF SYSTEMS TO PERFORM EXTRAVEHICULAR ACTIVITIES, MAN AND MANIPULATOR VOLUME 1: PERFORMANCE EFFECTIVENESS EVALUATION SCHEME (PEEVS) PART A: INSTRUCTIONS

Kenneth M. Mallory, Jr., Edward L. Saenger, and Thomas B. Malone 27 Apr. 1970 25 p refs
(Contract NAS8-24384)
(NASA-CR-102762) Avail: CFSTI CSCL 06K

The procedures for identifying free space activity systems are outlined. These steps are identification of EVA function and activity system, selection of system performance effectiveness and cost measures, identification of system with required capabilities and costs, and testing of system selection sensitivity to assumption and missing data. For Part B see N70-31892. Author

N70-32595*# Matrix Corp., Alexandria, Va.
SELECTION OF SYSTEMS TO PERFORM EXTRAVEHICULAR ACTIVITIES, MAN AND MANIPULATOR. VOLUME 1: PERFORMANCE EFFECTIVENESS EVALUATION SCHEME (PEEVS). PART C: WORKSHEETS
Kenneth M. Mallory, Jr., Edward L. Saenger, and Thomas B. Malone 27 Apr. 1970 27 p refs
(Contract NAS8-24384)
(NASA-CR-102764) Avail: CFSTI CSCL 06B

The worksheets provide a worked, although hypothetical, example of the PEEVS procedure. Some shortcuts are taken to reduce redundancy. Author

N70-32596*# Matrix Corp., Alexandria, Va. Human Factors Div.
SELECTION OF SYSTEMS TO PERFORM EXTRAVEHICULAR ACTIVITIES, MAN AND MANIPULATOR. VOLUME 2: Final Report
Edward L. Saenger, Thomas B. Malone, and Kenneth M. Mallory, Jr. 9 Apr. 1970 186 p refs
(Contract NAS8-24384)
(NASA-CR-102765) Avail: CFSTI CSCL 06B

The EVA problem is described, and the EVA functions are listed with associated task and performance requirements. The currently available methods for satisfying these requirements are discussed. Task, performance, and equipment requirements and capabilities are presented for manual EVA and for remote manipulator systems. Tradeoff and workbook methodologies are also discussed. Author

N70-32649# Naval Postgraduate School, Monterey, Calif.
EFFECT OF COLOR ON VISUAL VELOCITY ESTIMATION
Larry Allen Backus (M.S. Thesis) Oct. 1969 23 p refs
(AD-704076) Avail: CFSTI CSCL 5/10

The study reports an investigation of the effects caused by the color of a moving light source on the ability of subjects to estimate the velocity of that light source. The variable used for comparison was travel time estimated over fixed distances. The study also provides an investigation into possible differences in the travel time estimate between an experienced and an inexperienced group of subjects. The experiment varied the color of the light source, the distance over which the estimation was made, and the velocity of the light source presented to the subjects. Results showed that the color had no significant effect on the ability of the subjects to estimate travel time and, therefore, velocity. The results also showed that no significant difference existed between the groups of subjects tested. Author (TAB)

N70-32661# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF REFERENCE SIGNALS IN A VISUAL VIGILANCE TASK
Daniel Lewis Criswell (M.S. Thesis) Oct. 1969 31 p refs
(AD-704077) Avail: CFSTI CSCL 5/10

The effect of reference signals on performance in a visual vigilance task was studied under three conditions. Reference signals were presented on the same display as the real signals. In condition 1 (control), no reference signals were displayed. Subjects could demand reference signals whenever they wished in condition 2 (demand reference). Reference signals were programmed at arbitrary times during the experiment in condition 3 (programmed reference). Author (TAB)

N70-32752*# Webb Associates, Yellow Springs, Ohio.
AUTOMATIC CONTROLLERS FOR THE APOLLO LCG Final Report
Samuel J. Troutman, Jr. and Paul Webb Jun. 1970 62 p refs
(Contract NAS9-9778)
(NASA-CR-108540) Avail: CFSTI CSCL 06K

Automatic controllers were developed for laboratory tests of the liquid cooling garment in the Apollo full pressure suit. The three types of controller options, the nature of the diverter valve, modifications made to the Apollo LCG, and the general features of the test coverall are described. Operating procedures and the results of performance tests are presented. Construction and design details of each of four modified suits are given as appendices. R.B.

N70-32756# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PRELIMINARY PLANNING STUDY FOR RESCUE OF DISTRESSED SUBMERSIBLES Final Technical Report
2 May 1969 207 p refs
(Contract DOT-CG-93019-A)
(AD-705175; LMSC-D023780-1) Avail: CFSTI CSCL 13/10

The basic objective of the study was to provide the U. S. Coast Guard with preliminary technical data and program planning information necessary to define the development of an initial distressed submersible rescue capability and the costs associated with that development. The final study output is this summary report in which system concept descriptions are provided and data on estimated costs supplied. Author (TAB)

N70-32757# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF METHODS AND DEVICES FOR LOCATING SMALL DISTRESSED SUBMERSIBLES Final Technical Report
V. N. Thomas, D. P. Germeraad, R. Andris, J. Bentkowsky, J. Brophy et al Feb. 1970 235 p refs
(Contract DDT-CG-93019-A)
(AD-705167; LMSC-D052449) Avail: CFSTI CSCL 6/7

The task of locating a cooperative submarine, equipped with locator aids, is compared to that of locating a noncooperative submarine. It is shown that, if a cooperative search can be undertaken, the search and location operation is not the critical time segment of the rescue mission. If a noncooperative search must be undertaken, search and location becomes the critical time element. The most useful locator aid is found to be the underwater telephone, with which all submersibles are equipped. A generalized mathematical treatment is given, where the characteristics of the search equipment, the search vehicle, and the environment are treated in parametric form, along with the uncertainty in the location of the distressed submersible (DISSUB). Parametric analysis is applied to obtain realistic performance predictions. For the cooperative search, results are presented in the form of location time vs. range to the distressed submersible. For the noncooperative search, the results are presented in the form of curves of time to locate vs. probability of success. TAB

N70-32785# Naval Medical Research Inst., Bethesda, Md.
EVALUATION OF A DIVER'S THERMONUCLEAR SWIMSUIT HEATER SYSTEM Naval Medical Research Report
John F. Tauber, John S. P. Rawlins, and Kenneth R. Bondi 18 Feb. 1970 19 p refs
(AD-705084; Rept-3) Avail: CFSTI CSCL 6/17

The present state of the thermonuclear (i.e., radioisotope heat source) diver heating system is discussed and the results of the only dive to date using this system are reported. The inlet and outlet temperatures of the system are recorded together with the time-course of skin and rectal temperatures. It is concluded that the system in its present state is incapable of maintaining thermal balance in a diver at depth, and its use under SEALAB III conditions would entail a grave risk of hypothermia. Author (TAB)

N70-32855*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A STUDY OF RELATIONSHIPS BETWEEN AIRCRAFT SYSTEM PERFORMANCE AND PILOT RATINGS
W. C. Schultz, F. D. Newell, and R. F. Whitbeck Washington NASA Jul. 1970 62 p ref
(Contract NAS1-8765)
(NASA-CR-1643; Rept-1H-2748-B-1) Avail: CFSTI CSCL 05E

The results are presented of an experiment to determine the possible relationships that may exist between analytical performance predictors and pilot evaluation data for a complete pilot task. The task chosen was to fly an ILS approach from outer marker to middle marker. Results of the experiment indicate that: (1) Glide slope rms error score does not correlate with pilot rating for the ILS task. (2) There is no apparent linear combination of rms error scores that correlates with pilot rating for the ILS task. (3) The analyses of variance of glide slope rms error do not indicate that this measure is as sensitive as pilot rating. (4) Pilots frequently give a lower rating because of relatively poorer performance as they approach the middle marker. (5) Pilot rating is not readily apparent from records of glide slope error. D.L.G.

N70-33184*# Techtran Corp., Glen Burnie, Md.
MAN IN SPACE [CHELOVEK V KOSMOSE]
G. Titov Washington NASA Jul. 1970 9 p ref Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 10, Oct. 1969 p 4–6
(Contract NASw-2037)
(NASA-TT-F-12948) Avail: CFSTI CSCL 05H

Flier-cosmonaut answers readers' questions on the subject of the man and machine problem in cosmonautics and what is the role played by man in the piloting of space ships supplied with advanced complex automation facilities. Author

N70-33271# Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
TESTS OF WATER-FILLED CAPSULE IN PRONE POSITION Letter Report
R. F. Gray and M. G. Webb 13 Apr. 1959 10 p refs
(AD-704863; MA-5) Avail: CFSTI CSCL 6/17

The Aviation Medical Acceleration Laboratory (AMAL) G-capsule is a device to protect humans against the body distortion effects of high acceleration forces. It is a nonexpandable container designed to resist the outward expansion of the subjects body and positive pressure is used in his respiratory system to keep the body expanded against these external supports. The purpose of this support system is to protect the pilot against the distorting effects of acceleration which could be harmful. The principle new feature of this protective system is the use of pressure in the respiratory system to oppose distortion. TAB

N70-33285* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SURVIVAL COUCH Patent
Maxime A. Faget, William M. Bland, Jr., and Jack C. Heberlig, inventors (to NASA) Issued 12 Jun. 1962 (Filed 18 Sep. 1959) 4 p Cl. 5-345
(NASA-Case-XLA-00118; US-Patent-3,038,175; US-Patent-Appl-SN-840983) Avail: US Patent Office CSCL 06G

A protective couch for aircraft occupants subjected to a 3-g or 4-g force or for spacecraft crews is described. The couch consists of a sheet of lightweight, rigid Fiberglas having individualized recesses conforming to the lateral and posterior contour of a specific occupant, and a posterior layer of crushable cellular honeycomb shock absorbing material. N.E.N.

N70-33328# Joint Publications Research Service, Washington, D.C.
THE HABITABILITY OF ATOMIC SUBMARINES
A. Konychev 13 Jul. 1970 10 p ref Transl. into ENGLISH from Tekhn. i Vooruzheniye (USSR), no. 5, 1967 p 44–47
(JPRS-50927) Avail: CFSTI

It is shown that prolonged confinement of human subjects in isolated compartments leads to the formation of carbon monoxide and carbon dioxide. The admissable minimum oxygen concentration is 17% and the maximum carbon dioxide concentration is 1%. Carbon dioxide can be eliminated through chemical absorption by a filter of potassium salt of nitromethylalanine, and carbon monoxide is eliminated catalytic by oxydation into CO_2. Oxygen is regenerated by electrolysis of a sulfate solution or by biological one-cell algae systems. G.G.

N70-33342*# Systems Technology, Inc., Hawthorne, Calif.
RESEARCH ON DISPLAY SCANNING, SAMPLING, AND RECONSTRUCTION USING SEPARATE MAIN AND SECONDARY TRACKING TASKS
R. W. Allen, W. F. Clement, and H. R. Jex Washington NASA Jul. 1970 126 p refs
(Contract NAS2-3746)
(NASA-CR-1569; TR-170-2) Avail: CFSTI CSCL 05H

Theoretical models and corroborative experimental data are presented on the human operator's scanning behavior and tracking performance while simultaneously controlling two closed-loop tasks using separate displays. These results form a basis for estimating and correlating human performance and scanning workload in multidisplay piloting tasks. It is shown that the pilot's average scanning, sampling and reconstruction behavior can be accurately modeled by an adjustable quasi-linear describing function, plus an injected "scanning remnant" (observation noise) having wideband properties. Two likely mental processes for reconstruction of an estimated signal from the finite-dwell, almost-periodic samples are analyzed: a "switched gain" model and a "reconstruction-hold" model. The experimental data from this experiment favor the former. A theoretical model for the sampling remnant is given, which has the form of first-order-filtered noise; it depends on the displayed signal variance, sampling frequency, fixation dwell time and sampling frequency variations. The experimental remnant data fit this model well, and thereby provide good correlations between theoretical and experimental tracking performance measures. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-32038# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
THE DISSOCIATION AND RECOMBINATION OF NITROGEN: A COMPARISON BETWEEN THEORY AND EXPERIMENT
Ven H. Shui, John P. Appleton, and James C. Keck Feb. 1970 51 p refs
(Contract Nonr-1841(93))
(AD-705112; Publ-70-2) Avail: CFSTI CSCL 7/4

The phase-space theory of reaction rates, as developed by Keck, which incorporates the corrections due to nonequilibrium vibrational state populations, is used to calculate the overall recombination and dissociation rate coefficients of nitrogen in a heat bath of argon atoms. Substantial quantitative agreement is obtained between the theoretical predictions and the low temperature (90K - 811K) discharge-flow-tube measurements of the recombination rate coefficient and the high temperature (8000K - 15000K) shock-tube measurements of the dissociation rate coefficient. The working relationships required for applying the modified phase-space theory to predict the dissociation and recombination rate coefficients of other diatomic molecules in the presence of weakly attracting collision partners, such as argon atoms, are summarized. Author (TAB)

N70-32079 National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
ELECTROLYTIC CONDUCTANCE AND THE CONDUCTANCES OF THE HALOGEN ACIDS IN WATER
Walter J. Hamer and Harold J. De Wane May 1970 38 p refs
(NSRDS-NBS-33) Copyright Avail: SOD $0.50 Catalog No. C-13.48:33

Data evaluation of the electrolytic conductance of aqueous solutions of electrolytes is presented. The migration of ions and general rules governing the ion movement are considered using potential gradients. Values of the parameters, are given for the temperatures 0 to 100 C. Tabular data on the electrolytic conductance of HF, HCl, HBr and HI are included for various concentrations and temperatures, along with the constants governing the dissociation of HF from 0 to 25 C. J.A.M.

N70-32085# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
DETERMINATION OF OXYGEN CONCENTRATION IN SILICON AND GERMANIUM BY INFRARED ABSORPTION
W. R. Thurber May 1970 22 p refs
(NBS-TN-529) Avail: SOD $0.30 Catalog No. C13.46:529

Infrared absorption measurements were made at room temperature, 80K and 20 K to determine the absorption coefficient of oxygen in silicon and germanium single crystals. A study was done to compare the results of four experimental methods, which involved both absolute and difference procedures. Sources of error were identified, including that due to calculating the absorption coefficient with an approximate equation which neglects multiple internal reflections. Measurements made on the same specimen at several temperatures give additional data on the relation of oxygen concentration to absorption coefficient at low temperatures. Author

N70-32100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS CHROMATOGRAPHIC ANALYSIS OF LITHIUM CARBIDE IN LITHIUM HYDRIDE
O. V. Molchanova et al 20 Mar. 1970 9 p refs Transl. into ENGLISH from Tr. Vses. Nauchn. Issled. Konf. Po Gazovoi Khromatografii (USSR), no. 4, 1966 p 86–88
(AD-704764; FTD-MT-24-330-69) Avail: CFSTI CSCL 7/4

Gas chromatography was used to determine mixtures of lithium hydride and lithium carbide (lithium acetylide). The sample was decomposed with water and the gaseous products were passed through a chromatograph column packed with aluminum oxide of 0.25-0.5 mm particle size. Thermal conductivity or ionization detectors were used. The column temperature and the carrier gas are not mentioned. The lithium carbide content was calculated from the amount of C_2H_2 in the gas. Author (TAB)

N70-32107*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPLEX CHEMICAL EQUILIBRIUM CALCULATIONS
Sanford Gordon *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 1–15 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 07D

Many of the chemical and flow processes taking place in rockets and airbreathing engines occur at high temperatures. At these temperatures, for example, molecules break up into atoms or free radicals, some species react to form new species, or neutral species ionize. The result is that we often have to deal with mixtures containing many kinds of chemical species. If we want to know theoretical properties of these complex mixtures, such as thermodynamic or transport properties, it is first necessary to calculate the equilibrium composition of the mixtures. For a number of years Lewis has been working with equilibrium calculations for a wide variety of chemical systems. To carry out these calculations, we have developed mathematical procedures and computer programs. This paper is concerned only with the following topics: (1) a comparison between two formulations for chemical equilibrium; and (2) a comparison of some thermodynamic derivatives for reacting and nonreacting systems. Author

N70-32113*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION CHEMISTRY
Frank E. Belles *In its* Kinet. and Therodyn. in High Temp. Gases 1970 p 89–104 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 21B

This survey of combustion chemistry covers two aspects of the subject: (1) what is known about the reactions involved; all of this work has been done at other laboratories; and (2) what is known about the rates of these reactions and how to learn more. It is necessary to extract all possible performance from a combustion system, to understand the source and elimination of combustion-generated air pollutants, or to devise better ways to extinguish fires, then it also becomes necessary to know the important combustion reactions and their rates. Author

N70-32116*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL KINETIC COMPUTATIONS IN MULTIREACTION SYSTEMS
David A. Bittker *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 133–148 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 07D

Changes occurring in a complex reacting gas are the result of many individual chemical reactions occurring at the same time. Reliable experimental data can be used to observe the details of a reaction mechanism and to determine individual rate constant values. This is done by studying: (1) kinetics behind a shock wave; and (2) kinetics of reaction in a complex static system. On the other hand, known or estimated rate constants can be used to calculate practical things such as: (1) kinetic rocket performance; (2) ignition delays in combustible mixtures, and (3) ignition lengths and nozzle performance in supersonic flow. An example of each of these approaches is given later. Author

N70-32128# Stanford Univ., Calif. Dept. of Chemical Engineering.
REACTIVITY OF TUNGSTEN TOWARD HYDROCARBONS
Final Scientific Report
Michel Boudart and David F. Ollis Dec. 1969 9 p refs
(Contract AF 49(638)-1423)
(AD-703706; AFOSR-70-0382TR) Avail: CFSTI CSCL 7/4

The initial stages of carburization of hot tungsten by cold methane and cyclopropane was studied by LEED, X-ray diffraction

and optical microscopy. Under these conditions, the rate of hydrocarbon decomposition is dominated by the thermal accommodation: the transfer of energy from the hot surface to the cold reactant. This process in turn is found to be very sensitive to the state of the surface on wires, foils and oriented single crystals. Surface coincidence lattices are shown for the first time to offer poor thermal accommodation, and the resulting passivity is attributed to the smoothness of these surfaces on an atomic scale. Author (TAB)

N70-32130# Harvard Univ., Cambridge, Mass. Gibbs Chemical Lab.
THE OXIDATION OF CARBON MONOXIDE BY OXYGEN IN SHOCK WAVES
A. M. Dean and G. B. Kistiakowsky Mar. 1970 40 p refs
(Contract Nonr-1866(36))
(AD-705178) Avail: CFSTI CSCL 7/4

The oxidation of CO by O2, with and without small amounts of added H2, was investigated in very dilute mixtures with argon. The reaction was followed in incident shock waves by measuring CO and CO2 infrared emissions for about 2000 micro sec particle time over the 1700 to 2600 K range. The reaction shows an initial accelerating rate followed, in H2 mixtures, by a period of constant rate. The observed rates could not be explained by the other proposed mechanism, which postulated electronically excited CO2 as a chain carrier. Author (TAB)

N70-32138# Rensselaer Polytechnic Inst., Troy, N.Y.
THE PHOTOCHEMISTRY AND OPTICAL ROTARY DISPERSION OF PHOTOCHROMIC BIANTHRONES Final Report, 1 Jul. 1966 – 30 Jun. 1969
H. H. Richtol and R. L. Strong Apr. 1970 21 p
(Contract DA-31-124-ARO(D)-475)
(AD-704958; AROD-6364-2-C) Avail: CFSTI CSCL 7/5

An investigation has been performed on the photochromic behavior of bianthrone and some of its derivatives. The photochromic transients in benzene solution have been studied by flash photolysis from 20-55C. This state is produced via the singlet excited state and decays by first-order kinetics (k(1) = 3-11/sec at 25C), with an energy of activation of 14-15 kcal/mole. Triplet energy transfer experiments with biacetyl as triplet donor show that the triplet state of the bianthrones can be a precursor to the photochromic state through energy transfer. Permanent photolysis of the bianthrones to helianthrones and naphthodianthrones occurs through the singlet excited state. The photoproducts have transients which decay by second-order kinetics. 2-Carboxybianthrone was resolved and its ORD curve obtained, but unfortunately it had low rotations and high absorptivities. Author (TAB)

N70-32201# California Univ., Los Angeles. Dept. of Chemistry.
THE LOW TEMPERATURE CHEMISTRY OF HIGH TEMPERATURE MOLECULES
W. F. Libby Apr. 1969 10 p refs
(Grant AF-AFOSR-1255-68)
(AD-704615; AFOSR-70-1026TR) Avail: CFSTI CSCL 7/3

The report briefly summarizes research on the chemical behavior of ions as CH3(+), CH5(+), and C2H5(+), and the polymerization of carbon vapor in benzene. TAB

N70-32232# Royal Aircraft Establishment Farnborough (England).
STUDY OF THE KINETICS OF THE TRANSFORMATION OF THE C-N TRIPLE BOND IN POLYACRYLONITRILE FROM INFRARED ABSORPTION SPECTRA [IZUCHENIE KINETIKI PREVRASHCHENIYA C-N TROYNOI V POLIAKRILONITRILE PO IK-SPEKTRAM POGLHOSCHENIYA]
N. A. Kubasova et al Feb. 1970 8 p refs Transl. into ENGLISH from Vysokomol. Soedin., Ser. B., (Moscow), no. 3, 1969 p 193–196
(RAE-Lib-Trans-1441) Avail: CFSTI

Polyacrylonitrile films were heated in vacuum at temperatures in the range 205-270 C and the rate of disappearance of the nitrile group with time followed by IR spectroscopy. The reaction was the conversion of the nitrile group into a conjugated C double bond N structure. In the range 205-235 C, transformation with no degradation occurred with an activation energy of 41 kcal/mole. At 245-270 C some degradation occurred and the activation energy for nitrile conversion fell to 21 kcal/mole. Author

N70-32248# Georgia Inst. of Tech., Atlanta. School of Chemistry.
COMPLEX METAL HYDRIDES. HIGH ENERGY FUEL COMPONENTS FOR SOLID PROPELLANT ROCKET MOTORS Annual Report, 1 Mar. 1969 – 28 Feb. 1970
E. C. Ashby 1 May 1970 223 p refs
(Contract N00014-67-A-0159-0005)
(AD-705113; AR-2) Avail: CFSTI CSCL 7/2

Work was carried out to prepare new and unusual simple and complex metal hydrides of the main group metals, lithium, beryllium, magnesium, boron and aluminum. The philosophy of the endeavor was to pursue both the understanding of fundamental chemical reactions in the hydride area that are poorly understood or incorrectly reported as well as directing major attention to the synthesis of new compounds. The most notable contributions of the present report are the synthesis of the first alkali metal magnesium hydrides (KMgH3, NaMg2H5), the first stable HMgX compounds (HMgNR2), the development of extremely economic routes to aminoalanes (HA1(NR2)2) and aminoboranes (HB(NR2)2), first synthesis of RMgH compounds, the completion of detailed mechanistic studies of several fundamental reactions in the hydride area, and the inauguration of DTA-TGA investigations of both simple and complex metal hydrides. Author (TAB)

N70-32280*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POLYMER RESEARCH
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 231–241 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 07D

Chemical and physical properties of elastomers are discussed. Sterilizable, grafted membranes for silver zinc battery separators were exposed to KOH and the results are tabulated. The operation of a parallel plate viscometer is described for determining the viscosity of an oxidizer binder system. It is demonstrated that the molecular weight of polymers and telomers can be obtained from a relatively simple index of refraction measurement. The electronic conductivity of ionenes, viscoelastic behavior of elastomers undergoing scission reactions, and long term aging of peroxide-cured styrene butadiene rubber are discussed. N.E.N.

N70-32312*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF A MODIFIED KJELDAHL AND VACUUM FUSION TECHNIQUES FOR DETERMINATION OF NITROGEN IN TANTALUM ALLOYS
Warren F. Davis, Judson W. Graab, and Emery J. Merkle Washington Jul. 1970 21 p refs
(NASA-TM-X-2035; E-5620) Avail: CFSTI CSCL 07D

Results obtained for the determination of nitrogen in the tantalum-base alloys T-111 and T-222 by Kjeldahl and vacuum fusion procedures are compared. The Kjedahl method used consists of a rapid decomposition with HF-H3PO4-K2CrO4 followed by the highly sensitive colorimetry of nitroprusside-catalyzed indophenol.

The vacuum fusion procedure described uses a platinum-tin bath, platinum flux technique. In the 5 to 25 ppm range, the relative standard deviation was 3 to 9 percent by the Kjeldahl procedure and 4 to 6 percent by vacuum fusion. The agreement of the nitrogen results by the two techniques is considered satisfactory.
Author

N70-32358# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
CHROMIUM OXIDE ON CARBON BLACK, VALENCES AND DISPERSION OF THE CHROMIUM [CHROOMOXIDE OP CARBON BLACK, VALENTIES EN DISPERSIEGRAAD VAN HET CHROOM]
H. Cuppers and J. J. G. M. van Bokhoven Mar. 1970 47 p refs In DUTCH; ENGLISH summary
(TDCK-55651-III; Rept-1970-10) Avail: CFSTI

Six samples of carbon black (named Spheron-6) with various chromium contents were investigated because of the possible catalytic action on hydrolysis reactions. The degree of dispersion was measured by means of oxygen chemisorption. Although no absolute measure was found so far, it can be stated, that the chromium surface attains a maximum value at a chromium content of between two and five percent. The extent of reduction of hexavalent chromium during the impregnation process was determined by means of chemical and magnetic measurements. The chemical experiments involved a reaction of the impregnated carbon with hydrazine. The hydrazine reduced all chromium with a valence higher than three to valence three. From the amount of nitrogen liberated a mean value for the valence can be calculated. On account of the small effect the method is very inaccurate at chromium contents lower than five percent. Two magnetic measurements used were magnetic susceptibility and electron spin resonance.
Author

N70-32371# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PROMOTERS AND MECHANISMS OF SULPHUR HEXAFLUORIDE OXIDATION REACTIONS, DECEMBER 1968–JUNE 1969
Bernard Siegel and Peter Breisacher 1 Dec. 1969 23 p refs
(Contract F04701-69-C-0066)
(AD-705138; TR-0066(5210-10)-5; SAMSO-TR-70-161) Avail: CFSTI CSCL 7/2

Various gases can increase the rate of SF6 oxidation. The efficacies of these promoters were shown to be inversely proportional to their electronegativities, demonstrating that the unusual slowness of SF6-oxygen reactions is caused by the ability of the fluorines in SF6 to repel the highly electronegative oxygen. Although SOF4 is the principal sulfur oxyfluoride product of SF6-oxygen reactions, the presence of each of the promoters leads to a shift in products, primarily to SOF2 formation. However, SO2 formation is enhanced by the presence of relatively low hydrogen concentrations, and the level of SO2F2 formation is strongly influenced by the identity and concentration of the various promoters. These data are used to deduce detailed reaction mechanisms that are consistent with the observed products and thermochemical energetics.
Author (TAB)

N70-32372# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
A CHEMICAL REACTOR UTILIZING SUCCESSIVE MULTIPLE ELECTRICAL EXPLOSIONS OF METAL WIRES, JULY–NOVEMBER 1969
Richard L. Johnson and Bernard Siegel 1 Apr. 1970 23 p refs
(Contract F04701-69-C-0066)
(AD-705137; TR-0066(5220-50)-9; SAMSO-TR-70-159) Avail: CFSTI CSCL 14/2

A severe limitation in the use of the exploding wire phenomenon for chemical synthesis has been the relatively small amount of product that can be prepared by single metal explosions. This problem has been overcome by development of a successive multiple explosion technique in which a large number of wire explosions can be effected in rapid-fire order, without breaking the initial vacuum seal. Pre-set wires are contained in a cylinder that is rotated stepwise over an orifice, thereby dropping the wires into a lower chamber where contact is made with stationary electrodes, across which a high potential has been imposed. This technique is shown to be at least as effective as the single explosion technique in the preparation of compounds that are relatively free of unreacted metal. This technique can also be used for the preparation of specific particle sizes. The particle size of product powders is quite dependent upon the magnitude of the applied voltage. In general particle size decreases with increased voltage.
Author (TAB)

N70-32437# Army Foreign Service and Technology Center, Washington, D.C.
PULSE EXCITATION OF PHOTOCHROMATIC SPIROPYRANS [IMPULSNOYE FOTOVOZBUZHENIYE FOTOKHROMNYKH SPIROPIRANOV]
T. A. Shakhverdov 13 Jan. 1970 11 p refs Transl. into ENGLISH from Teor. Eksp. Khim. (URSR), v. 4, no. 3, 1968 p 421–424
(AD-700417; FSTC-HT-23-135-70) Avail: CFSTI CSCL 7/5

An investigation was made of the behavior of nitro substituted 1,3,3-trimethyl spiro(2H-1-benzopyran-2-2-indoline) after pulse photoexcitation at room temperature using a device which enables the photographic recording of the spectra of the intermediate forms after the irradiation of samples. Certain experiments on the kinetics of changes of these forms at different wave-lengths were conducted with photoelectric pulse instruments.
Author (TAB)

N70-32486# Princeton Univ., N.J. Frick Chemical Lab.
THERMAL STABILITY OF THE CARBON-CARBON CROSSLINKAGE IN POLYMER NETWORKS
Montgomery T. Shaw and Arthur V. Tobolsky Apr. 1970 23 p refs
(Contract N00014-67-A-0151-0011)
(AD-704907; RLT-123) Avail: CFSTI CSCL 7/4

The thermal stability of carbon-carbon crosslinkages in elastomeric systems was studied by comparing the vacuum chemical stress relaxation of samples with different concentrations of these crosslinkages. The systems studied included silicone rubber, crosslinked polyethylenes and Dexsil-201 rubber. Arrhenius activation energies of about 55 kcal/mole were found for the scission of these crosslinkages in the temperature range 300-350C. Crosslinkages added to a sample by additional curing were found to be, in general, more stable than those first formed. A more detailed analysis of the cleavage reaction was performed on peroxide cured Dexsil-201 elastomer - made possible because the main chains of this material are stable at the temperatures used. Two species of crosslinks were distinguishable: one having the same stability as the carbon-carbon crosslinkage in silicone rubber, another being ten times as stable and probably devoid of normal carbon-carbon bonds.
Author (TAB)

N70-32488# Army Foreign Science and Technology Center, Washington, D.C.
THE TASKS FOR FUNDAMENTAL INVESTIGATIONS OF POLYMER STABILIZATION [ZADACHI FUNDAMENTALNYKH ISSLEDOVANII PO STABILIZATSII POLIMEROV]
N. M. Emanuel 2 Mar. 1970 17 p refs Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), v. 39, no. 7, 1969
(AD-703570; FSTC-HT-23-289-70) Avail: CFSTI CSCL 7/3

A brief review is presented of the current state of research into polymer aging and stabilization. The need is noted for a general

theory of polymer aging and an explanation of the mechanisms by which stabilizers improve polymer performance. Author (TAB)

N70-32507# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMISORPTION OF PROPYLENE ON COPPER OXIDES STUDIED BY INFRARED SPECTROSCOPY
K. P. Zhdanova et al 10 Oct. 1969 14 p refs Transl. into ENGLISH from Probl. Kinetika i Kataliza (USSR), no. 12, 1968 p 211–215
(AD-700410; FTS-MT-24-177-69) Avail: CFSTI CSCL 7/4

In recent years as a result of study of the reaction of oxidation of propylene into acrolein by the method of tracers, a dissociative mechanism of adsorption of propylene on copper and bismuth-molybdenum catalyst was offered with the breaking away of the hydrogen atom from the methyl group and formation of allyl radical (or more correctly allyl complex with catalyst), which later under the influence of oxygen is oxidized to acrolein. Clarification of the mechanism of these reactions is the subject of the present work, the purpose of which was to study propylene sorption by infrared spectroscopy. As adsorbents cupric and cuprous oxides were selected. The obtained results agree with the previous data on the dissociative mechanism of adsorption of propylene on cuprous oxide, and also confirm the assumption on the adsorption of propylene on cupric oxide chiefly with respect to the double bond. Author (TAB)

N70-32525*# Scripta Technica, Inc., Washington, D.C.
REACTIVITY OF DIANHYDRIDES AND EFFECT OF THEIR HYDROLYSIS IN THE SYNTHESIS OF POLYAMINO ACIDS [O REAKTSIONNOY SPOSOBNOSTI DIANGIDRIDOV I EFFEKTE IKH GIDROLIZA V PROTSESSE SINTEZA POLIAMIDOKISLOT]
S. A. Zakoshchikov et al NASA Jun. 1970 5 p refs Transl. into ENGLISH from Vysokomol. Soedin., Ser. B (USSR), v. 11, no. 7, 1969 p 483–486
(Contract NASw-2036)
(NASA-TT-F-13118) Avail: CFSTI CSCL 07C

The studied dianhydrides of tetracarboxylic acids were thoroughly freed (purified) from traces of acetic acid by washing with dry dioxane and drying in a thermostat under vacuum. Hydrolysis of the dianhydrides was studied in a constant temperature cell with platinum electrodes connected to a measuring bridge with an a.c. sound-frequency source GZ-34 and a resistance box MSR-63. A SI-19B oscillograph was used as the a.c. galvanometer. The same apparatus was used to study the interaction of dianhydrides with diamines, the concentration of which was 0.1% in solution in dimethylformamide with a water content of 0.03%. It was found that the dianhydrides least stable to hydrolysis are the dianhydrides of pyromellitic and 3, 4, 3', 4'-diphenylsulfone tetracarboxylic acids. It was shown that copolymerization of dianhydrides with diamines proceeds at a rate which greatly exceeds the rate of hydrolysis of dianhydrides. Hydrolysis of anhydride groups plays an insignificant role in the general scheme of formation of polyamino acids in solution. Author

N70-32538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PENTAVALENT COMPOUNDS OF PHOSPHORUS
K. V. Karavanov et al 26 Feb. 1970 6 p Transl. into ENGLISH from the Russian
(AD-703546; FTD-MT-24-423-69) Avail: CFSTI CSCL 7/3

Alkyl(aryl)tetrafluoro phosphoranes (I) and dialkyltrifluoro phosphoranes (II) may be used as intermediates in the preparation of pesticides and other compounds. In the known methods, I and II are formed in low yield and in some cases deficit starting compounds are required. A new method is described by which I and II are formed in 75 to 80 percent yield. The reaction mixture is heated at 60 to 70 degrees centigrade with reflux. Methyltetrafluoro phosphorane, ethyltetrafluoro phosphorane, trichloromethyl-tetrafluoro phosphorane, phenyltetrafluoro phosphorane, and dimethyltrifluoro phosphorane were prepared by this method. Author (TAB)

N70-32539# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reactorentwicklung.
CALCULATION AND DRAWING OF THERMODYNAMIC PHASE DIAGRAMS WITH THE HELP OF AN ELECTRONIC DATA PROCESSING UNIT [BERECHNUNG UND ZEICHNUNG THERMODYNAMISCHER ZUSTANDSDIAGRAMME (PHUSENDIAGRAMME) MIT HILFE EINER ELEKTRONISCHEN DATENVERARBEITUNGSANLAGE]
Uri Grat and R. Hoerbe May 1969 52 p In GERMAN; ENGLISH summary
(Jul-596-RG) Avail: CFSTI

The described computer program calculates thermodynamic phase diagrams of three element systems, including associated compounds and their thermodynamic properties, from data for enthalphy, entropies, etc. Data for the free enthalpies are then used to calculate equilibrium lines corresponding to the phase transformations and to select the significant lines for a particular system. Main line points are either printed or transferred onto magnetic tape which in turn directs a plotter to draw the desired diagram. Transl. by G.G.

N70-32540# Kernforschungsanlage, Juelich (West Germany). Zentralinst. fuer Reaktorexperimente.
COMPUTER PROGRAM FOR PHOTO-PEAK ANALYSIS [RECHENPROGRAMM ZUR PHOTOPEAKANALYSE]
C. Meixner Feb. 1969 52 p refs In GERMAN
(Jul-572-RX) Avail: CFSTI

The described computer program performs a complete photo-peak analysis with additional energy calculation, correction of peak areas for photo-peak determination, and presentation of possible nuclides. The program is usable in activation analysis spectra as well as for exact energy determinations and is easily modified for special applications. The presented formulation is able to analyze spectra of 512 resp. 800 channels with a maximum of twenty lines. Transl. by G.G.

N70-32543# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
POLLUTION ANALYSIS: A BIBLIOGRAPHY OF THE LITERATURE OF ACTIVATION ANALYSIS
G. J. Lutz, ed. Jun. 1970 34 p refs
(NBS-TN-532) Avail: SOD $0.45

The literature of the use of activation analysis of pollution samples is reindexed in detail with respect to element determined, matrix analyzed, and technique used for precise literature searching. An author index is included. Author

N70-32557# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE EFFECT OF EXCESS Ge ON THE VISCOSITY OF GeO2
J. P. De Neufville, C. H. Drummond, III, and D. Turnbull Mar. 1970 28 p refs
(Contract N00014-67-A-0298-0009)
(AD-704805; TR-28) Avail: CFSTI CSCL 7/4

Viscosity measurements on GeO2-Ge liquids containing up to 8.5 mole % Ge additions were made using a rotating coni-cylindrical silica viscometer. The viscosity-temperature dependence was observed to be of the Arrhenius form over the

temperature range 1000-1300C. Comparison of these data with GeO2-Na2O viscosity data and an interpretation of the results are presented. Author (TAB)

N70-32576 National Lending Library for Science and Technology, Boston Spa (England).
CORROSION IN A FLUORINATING MEDIUM. 1: BEHAVIOR AND CHOICE OF MATERIALS [CORROSION EN MILIEU FLUORANT. 1: COMPORTEMENT ET CHOIX DES MATERIAUX]
L. Vincent et al 4 Feb. 1970 32 p refs In ENGLISH and FRENCH Transl. into ENGLISH from Energie Nucl. (Paris), v. 11, no. 7, Oct. 1969 p 400–410
(NLL-CA-Trans-231-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

Corrosion in a gaseous fluorinating phase was studied in reactions of fluorine with metals. The influence of temperature, pressure, mechanical strains, state of surface, purity, and crystal structure are discussed. A tabular guide to materials suitable for various industrial applications is included. F.O.S.

N70-32581# Kernforschungsanlage, Juelich (West Germany). Abteilung Dekontamination.
THE EFFECT OF CATALYSATORS ON THE DISSOCIATION OF PEROXIDE SULFATE AND PEROXIDE MONOSULFATE IN AQUEOUS SOLUTION [DER EINFLUSS VON KATALYSATOREN AUF DEN ZERFALL VON PEROXODISULFAT UND PEROXOMONOSULFAT IN WAESSRIGER LOESUNG]
R. Schulze-Rettmer, B. Buchheim and W. Schlenter Mar. 1969 94 p refs In GERMAN
(Jul-591-DE) Avail: CFSTI

Investigated were methods to reduce peroxide sulfate concentration in waste water of nuclear research facilities. The most effective of all catalysators was H(+) that accelerated the decay of peroxide sulfate at temperatures below 50 C. The addition of metal ions did not influence this reaction, with the exception of the silver ion. It is recommended to maintain acidity in the waste water as long as possible since protons reduce the peroxide sulfate residue markedly. Transl. by G.G.

N70-32587# Technische Hochschule Darmstadt (West Germany).
ON THE COPOLYMERIZATION OF STYROL AND P-IODINE STYROL: ABSTRACT [UEBER DIE COPOLYMERISATION VON STYROL UND P-JODSTYROL: AUSZUGSDRUCK]
Dinkar Chaudhari 1969 5 p In GERMAN
Avail: CFSTI

Considered are kinetics, viscosity-molecular composition, and behavior of styrol and p-iodone styrol copolymers in very dilute solutions. Styrol and p-iodone styrol were polymerized in benzole solution with azo isobutyronitril (AIBN) as initiator at 50 C. Copolimerization velocities were determined dilatometric and gravimetric; velocities increased with increasing content of p-iodine styrol in the monomer compound that formed proportional to the basic initiator concentration. Viscometric measurements on styrol and p-styrol copolymers, after conversion into poly p-lithium styrol by butyl lithium followed by hydrolysis into homopolystyrol, established also the dependence of the polymerization degree on the increasing content of p-iodine styrol in the copolymer. Transl. by G.G.

N70-32600# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
SPECTROSCOPIC MEASUREMENTS OF NITRIC OXIDE IN SPARK IGNITION ENGINES
George A. Lavoie Mar. 1970 39 p refs
(FML-70-4) Avail: Issuing Activity

The formation of nitric oxide in a spark ignition engine was monitored by means of time-resolved measurements of the NO + O recombination continuum, Radiation intensities from the CO + O continuum and the (0,0) band on the OH transition where used to estimate temperature, and oxygen atom concentration, by assuming that the species of the carbon-oxygen-hydrogen system were at local equilibrium. The results of the experiment show that the bulk of nitric oxide production occurs in the burned gas and that the contribution of the flame zone is negligible over the range of equivalence ratios 0.85 < or = to phi < or = to 1.1 and for normal engine conditions. The measurements compare favorably with calculations based on a previously developed kinetic model and show that for the purposes of engine studies, nitric oxide formation can be adequately described by an extended Zeldovich mechanism. Author

N70-32606# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF MECHANISM OF CATALYTIC REDUCTION OF NITROBENZENE AND CERTAIN OF ITS DERIVATIVES
V. P. Shmonina et al 10 Mar. 1970 27 p refs Transl. into ENGLISH from Tr. Inst. Khim. Nauk, Akad. Nauk Kaz. SSR (Alma-Ata), v. 7, 1961 p 38–53
(AD-704850; FTD-MT-24-435-69) Avail: CFSTI CSCL 7/3

Investigated were the kinetics of reduction of nitrobenzene, nitrobenzene-aniline intermediate products, their binary mixtures and a number of substituted nitrobenzenes on Raney nickel, platinum and palladium at atmospheric pressure of hydrogen and low temperatures. Data of catalytic reduction of mixtures of nitrobenzene-aniline products and analysis of reaction mixture in the course of reduction of nitrobenzene indicate that along with hydrogenation, i.e., successive interaction of nitro group with three molecules of hydrogen, there is possible non-catalytic bonding of intermediate products of nitrosobenzene and phenol hydroxylamine, leading to the formation of azoxybenzene, which further is transformed into aniline through azo- and hydrazobenzene. The path along which the process chiefly goes depends on the numerical ratio of reacting components on the surface of catalyst, which in turn, is determined by the nature of catalyst, temperature, composition of solvent, concentration of reducible substance, presence of different additions in the reaction mixture etc. Nature of the substituent does not always predetermine the effect which it will have on the speed of heterogeneous-catalytic reaction. Author (TAB)

N70-32631 National Lending Library for Science and Technology, Boston Spa (England).
SYNTHESIS OF HIGH MOLECULAR POLYHYDROXY COMPOUNDS CONTAINING ANTIMONY
D. A. Predvoditelev et al 28 Nov. 1969 4 p refs Transl. into ENGLISH from Vysokomolekul. Soedin, Ser. B (Moscow), no. 1, 1969 p 364–365
(NLL-M-7942-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The possibility of synthesizing the esters of high molecular polyhydroxy compounds containing antimony by reacting them with chloroanhydrides and esters of antimony acids was investigated. High molecular polyalcohols containing antimony were prepared by reacting cellulose, polyvinyl alcohol, and phenol formaldehyde resin with the anhydrides and esters. It was found that polyalcohols containing antimony are fire resistant when the content of antimony is sufficiently high. Author

N70-32661# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PURIFICATION OF METHYL TRICHLOROSILANE

V. A. Mikhailov et al 3 Mar. 1970 19 p refs Transl. into ENGLISH from the German
(AD-704756; FTD-HT-23-130-70) Avail: CFSTI CSCL 7/4

The principal concern of this report is the purification of methyltrichlorosilane (MTCS) by direct rectification. The calculation of coefficients of relative volatility of impurities in MTCS by means of the Hildebrand theory of regular solutions made it possible to establish that serious difficulties can arise only when separating MTCS from the impurity PCl3. It was shown that it is advisable to carry out rectification of materials for the purpose of purification in two stages. Simple equations which permit determination of the rectification conditions necessary to achieve a given level of purity were obtained. The construction of a laboratory rectification column suitable for purifying substances of the MTCS type is described. Its outstanding feature is a head containing no moving parts or cocks. As a result of rectification, MTCS with a content of the majority of impurities of < n x 10 to the -6th% was obtained. Author (TAB)

N70-32652# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE KINETICS OF THE CN BOND TRANSFORMATION IN POLYACRYLONITRILE BY IR ABSORPTION SPECTRA
N. A. Kubasova et al 23 Mar. 1970 9 p refs Transl. into ENGLISH from Vysokomolekul. Soedin., Ser. B (Moscow), v. 11, no. 3, 1969 p 193–196
(AD-704757; FTD-HT-23-155-70) Avail: CFSTI CSCL 7/4

The CN group of polyacrylonitrile (I) during heating in vacuo is converted to a CN group, conjugated with a ladder polymer. The kinetics of CN group conversion were studied while heating I at 205-70C. IR spectroscopy was used to determine the concentration of the CN groups. From the plots of optical density at 2240/cm vs. time the decompn. rate (r) of I was determined. Plotting log r vs. 1/T (T is temp.) gave an estimate of the process activation energy (E). In the latter case besides the conjugation of I also its thermal decompn. takes place. Author (TAB)

N70-32659# Naval Postgraduate School, Monterey, Calif.
SHOCK TUBE INVESTIGATION OF THERMAL CONDUCTIVITY IN NOBLE GASES
Federico A. Penaranda (M.S. Thesis) Apr. 1969 62 p refs
(AD-703655) Avail: CFSTI CSCL 7/4

A shock tube was developed and instrumented. The shock tube was used in an experiment in which the thermal conductivity of argon was determined in the temperature range of 1500 - 5000K and at relatively high pressures, 10 to 30 atmospheres. Author (TAB)

N70-32674*# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
SPECIFIC DESTRUCTION OF THE O2 EVOLVING REACTIONS AND THE PHOTORESTORATION OF O2 EVOLUTION Quarterly Status Report, 6 Apr.–21 Jul. 1970
21 Jul. 1970 8 p refs
(Contract NASw-1592)
(NASA-CR-110757; QSR-12) Avail: CFSTI CSCL 07C

Proof is presented for the hypothesis that in darkness, the O2 evolving reactions are irreversibly destroyed without effecting the System 2 quantum trapping centers. Quantum requirement measurements for O2 evolution were made before and after extraction of chloroplasts and several different algae with System 2 complexes. The kinetics of the annihilation of the O2 yielding reactions and the specificity of functional groups of molecules inducing the effect were investigated. The sensitivity of hydroxylamine extracted chloroplasts to photoinhibition was studied. R.B.

N70-32735# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
STUDY OF THE DECARBOXYLATION OF THORIUM TETRAFORMATE
Bernard Mentzen [1970] 40 p refs Transl. into ENGLISH from Ann. Chim. (Paris), v. 3, 1968 p 367–384
(RFP-Trans-65) Avail: CFSTI

The pyrolysis of thorium formate gave only ThO2 as a solid. No other solid formation was detected by thermogravimetric analysis, X-ray diffraction, or differential thermal analysis. The kinetics of the decarboxylation process of Th(HCOO)4 obeyed the Prout and Tompkins' law over the temperature range 225 to 280 C, with an activation energy of 36 Kcal mole. The gases formed from the decarboxylation of Th(HCOO)4 were analyzed by gas chromatography and mass spectroscopy in the temperature range 225 to 411 C. The primary gases of the thermolysis of Th(HCOO)4 were HCHO and CO2. Thoria acted simultaneously as a catalyst on the gaseous phase and for the pyrolisis of the solid. It is possible to follow the decarboxylation of thorium formate by metallic nickel arising from the simultaneous decomposition of nickel formate. NSA

N70-32739# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
MEV(14) NEUTRON GENERATORS IN ACTIVATION ANALYSIS: A BIBLIOGRAPHY
G. J. Lutz, ed. Jun. 1970 92 p refs
(NBS-TN-533) Avail: SOD $1.00 Catalog No. C13.46:533

The literature of 14-MeV neutron generators in activation analysis is reindexed in detail with respect to element determined, matrix analyzed and technique used for precise literature searching. An author index is included. Author

N70-32782# California Univ., Berkeley. Lawrence Radiation Lab.
X-RAY CRYSTALLOGRAPHIC STUDY OF CHLOROPHYLL ANALOGUES AND OTHER BIO-ORGANIC COMPOUNDS
Mark Samuel Fischer (Ph.D. Thesis) Dec. 1969 209 p refs
(Contract W-7405-eng-48)
(UCRL-19524) Avail: CFSTI

The crystal and molecular structures of two analogues of chlorophyll were determined by X-ray diffraction. The monohydrated dipyridinated magnesium phthalocyanin crystallizes in space group P2 sub 1/n. The biosynthesis and possible non-planarity of chlorophyll are discussed. The chlorophyll derivative methyl pheophorbide a crystallizes in space group P2 sub 1. With the use of molecular orbital calculations, a correlation between the phosphorescence energy of metalloporphyrins and the ionic radius of the central metal atom is predicted. Unsuccessful attempts to crystallize chlorophyll and a successful synthesis of zinc methyl chlorophyllide are described. The structures of two choline chloride analogues were determined, and space group information on the phosphonium analogue of choline chloride and choline bromide is listed. Betaine hydrochloride crystallizes in space group P2 sub 1/c. Author

N70-32793# Argonne National Lab., Ill.
DEPARTMENT OF CHEMISTRY, PART 2 Semiannual Report, Jun.–Nov. 1968
Feb. 1970 15 p refs Transl. into ENGLISH from CEA Rept. CEA-N-1148 p 82–97, 104–118
(ANL-Trans-797) Avail: CFSTI

Developments are reported for studies on: concentration by ion exchangers; chemical treatments by precipitation; evaporation by pulsed air; use of bacteria for effluent treatment; equipment for effluent treatment; recovery of enriched boron; and prototypes and chemical engineering assemblies for effluent treatment. Other developments are reported for studies on: treatment of enriched

uranium; new methods for treatment of uranium; and prototypes and chemical engineering assemblies for treatment of uranium. NSA

N70-32794# Argonne National Lab., Ill.
DEPARTMENT OF CHEMISTRY, PART 3 Semiannual Report, Jun.–Nov. 1968
Feb. 1970 22 p refs Transl. into ENGLISH from CEA Rept. CEA-N-1148 p 126–130, 154–155, 160–180
(ANL-Trans-798) Avail: CFSTI

Developments are reported for studies on: behavior of Zr alloys in water and superheated steam; corrosion behavior of steels; efficiency of passive films developed at various electrode voltages; and the constitution of oxide films on stainless steels in steam. Other developments are reported for studies on: use of ion exchange in desalination of sea water; electrochemistry of fused salts and electrocrystallization; and uses of electrolytic coatings. NSA

N70-32795# Argonne National Lab., Ill.
DEPARTMENT OF CHEMISTRY, PART 1 Semiannual Report, Jun.–Nov. 1968
Feb. 1970 78 p refs Transl. into ENGLISH from CEA Rept. CEA-N-1148 p 5–80
(ANL-Trans-796) Avail: CFSTI

Developments are reported for studies on: chemical analysis of Pu, chemical and electrochemical analysis in solution; preparation of irradiated or reconstituted fuel solutions (U and Pu) for analysis purposes; physiochemical analysis of Pu and isotopic analysis; high resolution, optical emission, atomic absorption and X-ray fluorescence spectrometry; gas analysis; chemical analysis in solution; control of nuclear materials; analyses of nuclear fuels; and analyses in the laboratory of the Cadarache Nuclear Center. NSA

N70-32820*# Translation Consultants, Ltd., Arlington, Va.
SPECTROGRAPHIC LOCAL MICROANALYSIS OF MINERALOGIC POLISHED SECTIONS [SPEKTROGRAFIKA LOKALNI MIKROANALYSA MINERALOGICKYCH NABRUSU]
I. Rubeska et al Washington NASA Jul. 1970 10 p Transl. into ENGLISH from Cas. po Mineral. A Geol. (Czechoslovakia), v. 7, no. 2, 1962 p 158–163
(Contract NASw-2038)
(NASA-TT-F-13145) Avail: CFSTI CSCL 07D

The identification of microparts of minerals in the form of polished blocks by local spectrographic microanalysis is discussed. Principal elements of the mineral component are qualitatively established with the aid of spark on one or two platinum electrodes. Quantitative analysis utilizes the method of liquid solution. The results of the analysis were practically applied in the study of paragenesis of silver, bismuth, cobalt, and nickel. Author

N70-32823*# Techtran Corp., Glen Burnie, Md.
A NEW CLASS OF STEPLADDER AND LADDER POLYMERS: THE POLYIMAZOPYRROLONES [UNA NUOVA CLASSE DI POLIMERI STEPLADDER E LADDER I POLIIMIDAZOPIRROLONI]
Mario Russo Washington NASA Jul. 1970 12 p refs Transl. into ENGLISH from Materia'le Plastica Elastomeri (Italy), v. 33, no. 11, 1967 p 1167–1171
(Contract NASw-2037)
(NASA-TT-F-13136) Avail: CFSTI CSCL 07C

A new class of heterocyclic ladder and stepladder polymers with especially high resistance to heat and radiation has been developed by workers at Langley Research Center. These show promise of successful application in space vehicles. Author

N70-32826*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION-INDUCED PREPARATION OF METALS FROM THEIR AQUEOUS SALT SOLUTIONS
Warren H. Philipp and Stanley J. Marsik Washington Jul. 1970 14 p refs
(NASA-TN-D-5880; E-5823) Avail: CFSTI CSCL 02D

Eleven metals, copper, zinc, cadmium, thallium, tin, lead, antimony, nickel, cobalt, iron, and palladium, were prepared from their aqueous salt solutions by irradiation with 2-MeV electrons. In the more successful attempts, the metal yields nG(M) (atoms per 100 eV multiplied by the valence change n) averaged about 2. The yields are interpreted in terms of the radical scavenging mechanism and the chemistry of the metal system involved. Author

N70-32836*# Colorado School of Mines, Golden. Chemical and Petroleum Refining Engineering Dept.
A MICROSCOPIC AND THERMAL STUDY OF THE SOLIDIFICATION OF HEXADECANE Annual Summary Report, 21 Nov. 1968–31 Dec. 1969
J. O. Golden and F. J. Stermole 31 Dec. 1969 61 p ref
(Contract NAS8-30511)
(NASA-CR-102786; ASR-1) Avail: CFSTI CSCL 07C

The n-paraffins are studied as potential candidate phase change thermal control materials and to gain a detailed understanding of their solidification processes both on earth and in space. Therefore, the goal of this investigation is two-fold: (1) Develop an improved microphotography apparatus for observing the phase change process; and (2) Perform meaningful studies on the crystallization dynamics of the solidification of the n-paraffins. The microphotography apparatus was successfully developed with the improved features being variable magnification and a modified test cell mounting procedure. This equipment was then used to study the solidification process of hexadecane under a variety of experimental conditions. Parameters investigated were average interfacial velocity, crystal peak height, individual crystal growth rates, crystal morphology and temperature response of the test cell. Author

N70-32842*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISSOCIATION RATES OF SHOCK-HEATED BROMINE IN PRESENCE OF HELIUM AND XENON
Marvin Wershay Washington Jul. 1970 15 p refs
(NASA-TM-X-2047; E-5428) Avail: CFSTI CSCL 07D

The rates of dissociation of bromine (Br2) in the presence of helium (He) and xenon(Xe) were measured behind the incident shock. The light absorption technique was used to measure Br2 concentration. The temperature range was 1200 to 1950 K. In addition, an indication of the efficiency of Br2 itself as a collision partner was determined and used in the data reduction of the 1-percent-Br2-noble-gas mixtures. Also included in the data reduction were corrections for the effects of boundary layer buildup. Author

N70-32846*# Midwest Research Inst., Kansas City, Mo.
PREPARATION OF PURE LITHIUM HEXAFLUOROARSENATE Final Report
Edward W. Lawless 20 May 1970 62 p refs
(Contract NAS3-12979)
(NASA-CR-72640; MRI-3325-C) Avail: CFSTI CSCL 07D

Methods for the preparation and analysis of high purity lithium hexafluoroarsenate, LiAsF6, were studied. Two thousand grams of LiAsF6 were ultimately prepared by neutralization of aqueous HAsF6 with LiOH solution followed by multiple recrystallization of LiAsF6 x 3H2O from water and vacuum drying

at 40 C to yield the anyhydrous salt. The final product contained not more than 100 ppm of any impurity on an elemental basis. Two other methods for the preparation of LiAsF6 were also successful, but were less suited to scale-up on the basis of product purity and experimental considerations. A fourth proposed synthesis method was unsuccessful. Analytical techniques which were used to determine product purity were carefully evaluated by exhaustive analyses of standard samples and the final product. Author

N70-32850# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
PREPARATION AND PROPERTIES OF URANIUM FORMATES
Rene Bressat et al [1969] 13 p refs Transl. into ENGLISH from Bull. Soc. Chim. France (Paris), no. 12, 1968 p 4807–4811 Sponsored by AEC
(RFP-Trans-64) Avail: CFSTI

Methods for the preparation of uranyl formates are described. The anhydrous salt is characterized by its X-ray diffraction pattern. The best conditions for electrochemical reduction of uranyl formate were studied. Several formates corresponding to stage IV oxidation of uranium were isolated and characterized. Among them U(HCOO)4 occurs in at least two allotropic forms for which the X-ray diffraction diagrams are given for the first time. Author (NSA)

N70-32872# Argonne National Lab., Ill.
DEPARTMENT OF CHEMISTRY, PART 6 Semiannual Report, Jun.–Nov. 1968
Feb. 1970 39 p refs Transl. into ENGLISH from CEA Rept. CEA-N-1148 p 336–368, 415–416
(ANL-Trans-801) Avail: CFSTI

Developments are reported for studies on: formation of silver double salts in concentrated solutions of cesium and quaternary ammonium halides; properties of heptavalent Np in solution; kinetics of Am(5) reduction by hydrogen peroxide; and effects of organic diluent on Pu(4) extraction by tridodecylamine in nitric acid solution. Other developments are reported for studies on: extraction of Np(4) in presence of nitrous acid by TBP; recovery of Np-237 and separation of Np-237 - Pu-239 by TLA extraction; Am-Cm seperation by extraction of tridodecylammonium nitrate; Am-241 recovery from Pu purification effluents; fabrication of Np, Am, and Pu targets for irradiation; fabrication of actinide element sources; preparation of metallic Pu-238 for fabrication of sealed sources; and cell for production and study of transuranium elements. NSA

N70-32901 National Lending Library for Science and Technology, Boston Spa (England).
THE SOLID-LIQUID EQUILIBRIA OF THE BINARY POTASSIUM HYDROXIDE-WATER SYSTEM
Roger Cohen-Adad et al 28 Nov. 1969 5 p refs Transl. into ENGLISH from Compt. Rend., v. 242, no. 21, 1956 p 2569–2571 Presented at a meeting, 23 May 1956
(NLL-M-7982-(5828.4f)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Two experimental methods were used to renew the study of the solid-liquid equilibria of the binary potassium hydroxide-water system. These two methods included: thermal treatment designed to lead to crystallization and solubility measurements. An analysis of the heating curves indicated flat portions and freezing points which enabled the plotting of the liquidus lines. J.M.C.

N70-32914# California Univ., Berkeley. Lawrence Radiation Lab.
SURVEY OF THE LITERATURE ON THE CARBON-HYDROGEN SYSTEM
R. A. Krakowski and D. R. Olander Mar. 1970 70 p refs
(Contract W-7405-eng-48)
(UCRL-19149) Avail: CFSTI

The literature on the carbon-hydrogen system up to ca 1968 is reviewed. The thermodynamics and heterogeneous kinetics of the reaction, the adsorption of hydrogen on graphite, and the evaporation of graphite are considered. Author (NSA)

N70-32958# Horizons, Inc., Cleveland, Ohio.
SYNTHESIS OF NEW LOW-TEMPERATURE PETROLEUM-RESISTANT ELASTOMERS Final Report, 3 Apr.–2 Dec. 1969
Selwyn H. Rose, Kennard A. Reynard, and James R. Cable Jan. 1970 21 p refs
(Contract DAAG46-69-C-0076-P001)
(AD-704332; AMMRC CR-70-1) Avail: CFSTI CSCL 7/3

The copolymer, (NP(OCH2CF3)2 - NP(OCH2C3F7)2)n, is an elastomer with a glass transition temperature of -77C that has an initial decomposition point of 300C in air on a thermobalance at a heating rate of 2 1/2 deg C minute. A high molecular weight sample had a tensile strength of 680 psi and an elongation of 800 per cent. The elastomer is very inert chemically and is soluble only in selected fluorocarbon solvents. When placed in a direct flame, the material softened and vaporized but would not burn. The copolymer has been successfully scaled up to the one-half pound scale. Preliminary experiments have demonstrated the feasibility of cures with certain peroxides or amines at 300F. The preparation and characterization of a number of analogous materials has been initiated. These include the (NP(OCH2C3F7)2)n homopolymer, which may be of utility as a base for solvent and chemical resistant coatings; the (NP(OCH2C3F7)2) - (NP(OCH2C7F15)2)n copolymer, which appears to be more solvent and chemically resistant than the copolymer of primary interest; and the (NP(OCH2C2F4H)2) - NP(OCH2C6F12H2)n copolymer, which appears to have a desirable combination of properties and utilizes relatively inexpensive starting materials. Author (TAB)

N70-32966# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Heisse Chemie.
DEPENDENCY OF THE CHEMICAL BEHAVIOUR OF MOLYBDENUM RECOIL ATOMS IN METAL CARBONYLS ON THE ENERGY AND THE ISOTOPE
E. Henrich and G. K. Wolf Oct. 1969 19 p refs Presented at Intern. Conf. on the use of Cyclotrons in Chem., Met., and Biol., Oxford, 22–23 Sep. 1969 Prepared in cooperation with Heidelberg Univ.
(KFK-1067; CONF-690924-2) Avail: AEC Depository Libraries

The chemical behavior of different isotopes recoiling from nuclear reactions is discussed. Elements ranging from molybdenum to indium were irradiated in close contact with Cr(CO)-6 with 600-MeV protons. The Mo-99 and Mo-93m recoil atoms have energies dependent on the mass difference between target and product reacted with the Cr(CO)-6 forming Mo(CO)-6. The yield of this reaction was determined in relation to the individual isotopes and their recoil energy. Author (NSA)

N70-32967# Kernforschungszentrum, Karlsruhe (West Germany). Lab. fuer Isotopentechnik.
INVESTIGATION OF THE DECONTAMINATION ACTION OF COMMERCIAL AND LABORATORY DETERGENTS [UNTERSUCHUNGEN ZUR DEKONTAMINATIONSWIRKUNG HANDELS- UND LABORUEBLICHER REINIGUNGSMITTEL]
J. Schmitz Jul. 1969 23 p refs In GERMAN; ENGLISH summary
(KFK-1019) Avail: AEC Depository Libraries

Comparative tests of the decontamination efficiency of commercial detergents, caustic soda solutions, hydrochloric acid, chromosulfuric acid, and water are discussed. Ground glass joints were contaminated to saturation by iodine, barium, and cesium isotopes. The contaminated glass sections were suspended in the

solution to be investigated and after an established time interval the residual activity on the ground glass section was measured. The plotting of the residual activity against the reaction time of the detergent yielded the decontamination curve, from which the decontamination efficiency of the detergent could be read directly.
Author (NSA)

N70-32979# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
INVESTIGATION OF THE RECOIL CHEMISTRY OF O 19 AND OF RADIOLYSIS OF WATER BY REACTOR RADIATION
W. Blaser Feb. 1970 79 p refs In GERMAN
(EIR-173) Avail: AEC Depository Libraries

The recoil chemistry of O-19 and its effects on the radiolytic processes in pure water under reactor irradiation were investigated. Calculations yielded a recoil energy of 441.5 eV for the O-19 atom and an increase in the internal energy of the H2O(19) molecule of 42.1 eV, which is enough to completely split off the O-19 atom. It was concluded that in about 50% of the cases the thermalizing tracks of O-19 depend on molecular combinations O-19–O(H2O2, O2H, O2). A large part of the products with O-19–O bonds results from reactions of H radicals and hydrated electrons with H2O(19) in water radiolysis.
NSA

N70-33022# Oak Ridge National Lab., Tenn. Chemical Technology Div.
UNIT OPERATIONS SECTION Quarterly Progress Report, Jul. – Sep. 1968
M. E. Whatley, P. A. Haas, L. E. McNeese, A. D. Ryon, C. D. Watson Apr. 1970 100 p refs
(Contract W-7405-eng-26)
(ORNL-4366) Avail: CFSTI

Progress is reported under three headings: engineering separation of macromolecular biological substances, sol-gel development studies, and molten-salt reactor processing studies.
NSA

N70-33042# Indiana Univ., Bloomington. Dept. of Chemistry.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS INTO THE ELECTRONIC STRUCTURE OF ATOMS AND MOLECULES BY USE OF SCATTERING TECHNIQUES Final Report, 1 Feb. 1968 – 30 Nov. 1969
Russell A. Bonham 30 Nov. 1969 9 p refs
(Contract AF 49(638)-1681)
(AD-702841; AFOSR-70-0692TR) Avail: CFSTI CSCL 7/4

A summary is given on research in which electron diffraction was employed to measure experimentally the shape of charge distributions surrounding atoms and molecules. The research showed that: It was possible to obtain experimental intensity data of sufficient accuracy to provide sensitive tests for the best available theoretical wave functions for simple atomic systems. That the Born theory of scattering is amazingly accurate. (.1% or better) for atoms (Ne) at high incident electron energies (40keV); and that data for simple polyatomic systems (N2, CO2, N2O, CH4) can be obtained which provides a more sensitive measure of deviations of the electron density from a test model of the density than any currently available theoretical wave function.
TAB

N70-33067# Research Inst. of National Defence, Stockholm (Sweden).
ON THE SEPARATION AND DETERMINATION OF FLUORINE. 5: DETERMINATION OF 0.5-7 MICROMOLES FLUORINE (AND 0.3-4 MICROMOLES CHLORINE) IN PLUTONIUM METAL BY PYROHYDROLYSIS AND SPECTROPHOTOMETRIC ANALYSIS
L-H. Andersson and B. Gelin Jan. 1970 9 p refs In SWEDISH
(FOA-4-4407) Avail: AEC Depository Libraries

A method is described for determining 0.5 to 7 micromoles fluorine and 0.3 to 4 micromoles chlorine in plutonium metal by pyrohydrolysis and spectrophotometric analysis. An apparatus for pyrohydrolytic separation enclosed in a glove-box is described. The sample was heated to about 900 C in a flow of argon gas saturated with steam. The metal was oxidized and the halogens from hydrogen halides are, with the argon gas, brought down into a receiver containing dilute alkali solution. The fluoride and chloride ions are determined spectrophotographically in this solution. The best samples were 0.2 to 0.5 plutonium metal. The standard deviation was 0.4 for both fluorine and chlorine.
NSA

N70-33077# Oak Ridge National Lab., Tenn.
ADSORPTION AND DESORPTION OF IODINE ON MILD STEEL
F. H. Neill Apr. 1970 55 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2763) Avail: CFSTI

The deposition of iodine on mild steel surfaces was investigated for a range of surface temperatures from 316 to 538 C and for two iodine gas-phase source concentrations. Adsorption rates and desorption rates for the sorbed species as a function of surface temperature were determined. The desorbing species was predominantly iron(II) iodide. The experimental data were used to prepare charts showing net adsorption rates and coefficients of desorption.
Author (NSA)

N70-33098# Strasbourg Univ. (France). Faculte des Sciences.
CHEMICAL BEHAVIOR OF C 14 AND N 13 HOT ATOMS IN NITRIDES AND CYANIDES [SUR LE COMPORTEMENT CHIMIQUE DES ATOMES CHAUDS DE CARBONE 14 ET D'AZOTE 13 DANS LES NITRURES ET LES CYANURES]
Jean-Georges Kuhry (Ph.D. Thesis) 1970 101 p refs In FRENCH
(NP-18126) Avail: AEC Depository Libraries

The targets were irradiated either by thermal neutron fluxes in CEA reactors (for C-14), or by 14-MeV neutrons (for N-13). After the targets were dissolved, the labeled compounds were separated in presence of carriers. Gases were analyzed by gas radiochromatography. The chemical behavior of the recoil atoms C-14 and N-13 in the nitrides was studied first. The total activity in C-14 is distributed over four chemical forms: carbide, cyanide, cyanamide, and isocyanate. The carbide and the cyanide are found to be the only two compounds produced in a primary stage. The field ratio of the two species varies as a function of the atomic radii. The proportion of the carbide C-14 increases with the relative probability of collision with nitrogen. No significant effect could be found for the atomic masses, in opposition with atomic radii effects. The collisions are found to be inelastic. The bonds in Ca3N2 and Ba3N2 are becoming ionic and the yield in carbide C-14 decreases.
NSA

N70-33148# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE ADMIXTURES IN ZIRCONIUM DIOXIDE
G. A. Pevtsov et al 12 Mar. 1970 9 p refs Transl. into ENGLISH from Gos. Kom. po Khim. Metody Analiza Khim. Reaktivov i Preparatov (USSR), v. 15, 1968 p 58–60
(AD-704835; FTD-HT-23-153-70) Avail: CFSTI CSCL 7/4

The article describes the procedure, reagents, and equipment used for determination of the admixtures in zirconium dioxide. The outstanding characteristic of the method is the simultaneous determination of seven admixtures.
Author (TAB)

N70-33186*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL DETERMINATION OF THE RATE OF DISSOCIATION OF FLUORINE IN A SHOCK TUBE [EXPERIMENTELLE BESTIMMUNG DER DISSOZIATIONSGESCHWINDIGKEIT VON FLUOR IN EINEM STOSSWELLENROHR]
Th. Just et al Washington NASA Jun. 1970 31 p refs Transl. into ENGLISH of Deut. Luft- und Raumfahrt Rept-70-02
(Contract NASw-2037)
(NASA-TT-F-12946; Rept-70-02) Avail: CFSTI CSCL 07D

In a shock tube the rate of dissociation of molecular fluorine was determined in a mixture of 10% F2 and 90% Ar in the temperature range of 1,200 to 1,500 K. Behind the incident shock wave the course of reaction was followed using the light absorption by the F2-molecules at a wave length of 313 nm. In comparison to the rate constant for a mixture of 10% F2 and 90% Ar the energy of activation is clearly closer to the energy of dissociation and therefore is physically more probable. Author

N70-33211# Universidad Nacional Autonoma de Mexico, Vilas Obregon. Facultad de Ingenieria.
NATURAL CALCIUM FLUORIDE AS RADIATION THERMOLUMINESCENT DOSIMETER [EL FLUORURO DE CALCIO NATURAL COMO DOSIMETRO TERMOLUMINISCENTE DE RADIACION]
Victor Manuel Maza del Torno (Ph.D. Thesis) 1969 61 p refs In SPANISH Supported in part by the Comision Nacional de Energia Nucl.
(NP-18179) Avail: AEC Depository Libraries

The properties of natural calcium fluoride as a thermoluminescent dosimeter are studied. The phenomenon of thermoluminescence is described and a mathematical model is given. Possible applications of thermoluminescent dosimetry are considered. The experiments carried out are described and the results obtained are shown graphically. NSA

N70-33269# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
RELATIONS BETWEEN THE KINETICS OF OXIDATION OF ALPHA ZIRCONIUM AND THE DIFFUSION PHENOMENA OF OXYGEN THROUGH THE OXIDE FILM AND IN THE UNDERLYING METAL [RELATIONS ENTRE LA CINETIQUE D'OXYDATION DU ZIRCONIUM ET LES PHENOMENES DE DIFFUSION DE L'OXYGEN DANS LE FILM D'OXIDE ET LES METAL SOUS-JACENT]
Gerard Beranger (M.S. Thesis—Paris Univ.) Jan. 1970 164 p refs In French
(CEA-N-1130) Avail: AEC Depository Libraries

The oxidation of alpha zirconium in oxygen at 550 to 850 C at atmospheric pressure for exposure times of less than 100 hr was investigated. After a deviation in the initial stage, the reaction kinetics follow a parabolic law. The growth of superficial oxide film and the dissolution of oxygen in metal are the simultaneous and elementary processes characterizing zirconium oxidation. The kinetics of these reactions also follow a parabolic law. A deviation from this law is only observed for the growth of the oxide at the beginning of the reaction. A nondestructive method for the analysis of oxygen, based on the application of the nuclear reaction O-16(d,p)O-17 was developed for the quantitative determination of the diffusion profile of oxygen dissolved in zirconium. The temperature dependence of the oxygen diffusion coefficient in zirconium, determined by means of microhardness measurements, reveals a rapid diffusion at t < 650 C. Author (NSA)

N70-33273# Princeton Univ. Observatory, N.J. Spectroscopy Lab.
ATOMIC AND MOLECULAR LIFETIME MEASUREMENTS Final Technical Report, 1 Jul. 1968 - 31 Aug. 1969
Lyman Spitzer, Jr. 3 Dec. 1969 8 p ref
(Contract F44620-67-C-0110; ARPA Order-1011)
(AD-705226; AFOSR-69-3033TR) Avail: CFSTI CSCL 7/4

The spectroscopy laboratory at Princeton University Observatory has conducted a successful program of radiative lifetime determinations in atomic and molecular transitions. The report provides a brief summary of the results. TAB

N70-33291*# Techtran Corp., Glen Burnie, Md.
DIRECT INTRODUCTION OF AMINO GROUPS INTO THE NUCLEUS OF AROMATIC NITRO COMPOUNDS [DIRECTE EINFUEHRING VON AMINOGRUPPEN IN DEN KERN AROMATISCHER NITROKOERPER]
Jacob Meisenheimer et al Washington NASA Jun. 1970 13 p refs Transl. into ENGLISH from Chem. Ber. (Weinheim), v. 39, 1906 p 2533 - 2542
(Contract NASw-2037)
(NASA-TT-F-13036) Avail: CFSTI CSCL 07C

Nitro, dinitro, and trinitro compounds are subjected to treatment with hydroxyl amine and processes of the reaction are discovered and their products analyzed, described, and compared with the literature. In the experimental part, methods are indicated for the production of m-dinitro m-phenylene diamine, sodium salt from s-trinitro benzene, 2,6-dinitro 3-toluidin, 2-nitro l-naphtyl amine, and m-nitro benzhydroxam acid by the use of hydroxyl amine. The products are described as to their appearance, solubility, melting points, and percentage of yield. Author

N70-33391# Joint Publications Research Service, Washington, D.C.
THERMAL STABILITY OF MODIFIED WATER
B. V. Deryagin et al 18 Jun. 1970 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 191, no. 4, 1970 p 859 - 861
(JPRS-10769) Avail: CFSTI

The structure of the anomalous component of polywater molecules was investigated with respect to its thermal strength and the possible composition of the decay products of the molecules. After heating to various temperatures in quartz capillaries set up in air, the change in the pattern of thermal expansion of polywater was studied. The computed and experimentally derived values for the length of the condensate columns were compared and found to be in good agreement. It is concluded that the high thermal stability of the anomalous component of the molecules is responsible for the stability of polywater. R.B.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-32017# Army Electronics Command, Fort Monmouth, N.J. Inst. for Exploratory Research.
RADAR RESPONSE OF LONG WIRES
F. Schwering Mar. 1970 64 p refs
(AD-704954; ECOM-3246) Avail: CFSTI CSCL 17/9

Scatter field and radar response of an infinitely long straight metallic wire are derived assuming that the wire is illuminated by an antenna radiating a Gaussian beam of narrow beam width. The scatter field has essentially the same distribution in any plane through the wire axis; it varies from plane to plane by only an amplitude factor. The radar response is at a maximum for vertical

incidence - when the beam axis intersects the wire axis at right angles - and decreases exponentially with increasing inclination of the beam axis against this direction. No side lobes are obtained for Gaussian illumination, at least not in the interesting range of small angular deviations from vertical incidence where the radar response has appreciable values. Two cases can be distinguished: (1) the wire crosses the Fresnel region of the antenna and (2) the wire is situated in the antenna far zone. In the former case, the theory is limited to wire radii not exceeding the beam radius at the antenna; in the latter case, arbitrary wire radii are admissible. If the wire is located in the far field region of the antenna, the expression derived for the radar response can be generalized so that it applies to any antenna characteristic. The generalized expression shows that a radar cross section can be assigned to the wire even though it has been assumed to be infinitely long; this radar cross section increases linearly with distance between antenna and wire. Author (TAB)

N70-32022# Naval Research Lab., Washington, D.C.
DETECTION RESULTS FOR FLUCTUATING TARGETS Interim Report
G. V. Trunk 24 Feb. 1970 17 p refs
(AD-704467; NRL-7039) Avail: CFSTI CSCL 17/9

Sea-clutter measurements using high-resolution radar indicate that clutter cross-section returns do not usually follow a Rayleigh distribution. The log-normal and contaminated-normal descriptions of sea clutter have been considered; and detection curves for nonfluctuating targets and for these distributions have been generated for the mean, median, and trimmed-mean detectors. In this report the detection calculations are repeated for fluctuating targets, specifically Swerling II and IV fluctuations. For the log-normal distribution, the trimmed-mean is the most effective detector; and the median is slightly better than the mean. For the contaminated-normal distribution, the mean is slightly better than the trimmed-mean, which is better than the median. Author (TAB)

N70-32067# Air Force Cambridge Research Labs., Bedford, Mass.
TRADEOFF ESTIMATES FOR DIGITAL SIGNALLING OF CANNED VOICE MESSAGES
Caldwell P. Smith Feb. 1970 15 p refs
(AD-704557; AFCRL-PSRP-405; AFCRL-70-0094) Avail: CFSTI CSCL 17/2

The digital data storage requirements for various methods of generating a vocabulary of spoken messages from stored digital data were compared for pulse-code modulation (PCM), variable-slope delta modulation (VSD), a channel vocoder synthesizer, and a compound storage scheme involving the use of the vocoder synthesizer in conjunction with a stored table of spectrum pattern events. The communications concept involves transmitting a digital number to designate a particular message (word, phrase, or sentence) from a fixed repertoire. At the receiving station the message number retrieves stored digital data from a memory device to generate the spoken message. While the channel vocoder permits much greater economy in data storage than the use of PCM or VSD, the compound storage arrangement using an auxiliary digital store of spectrum pattern data provides significant additional economy in data storage. Author (TAB)

N70-32073# Illinois Univ., Urbana. Coordinated Science Lab.
ON THE EQUIVALENCE OF FREE DISTANCE AND COLUMN DISTANCE OF A CONVOLUTIONAL CODE
Frank Ellwood Bell, III Apr. 1970 43 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-2339)
(AD-704650; UILU-ENG-70-207; R-462) Avail: CFSTI CSCL 9/4

A brief discussion of the role of coding theory in a communications system is followed by a description of convolutional codes and various distances measures. Two theorems and several corollaries concerning free distance are presented. The first theorem is essentially a correction of a counterexample to a conjecture relating free distance and column distance. The second demonstrates a necessary and sufficient condition for the free distance of a canonic systematic code to equal its order M column distance. A corollary shows that the condition is a sufficient one for a nonsystematic code also. Two expressions for the probability of undetectable error of a specific code are presented. Author (TAB)

N70-32120*# Philco-Ford Corp., Palo Alto, Calif. Space and Reentry Systems Div.
STUDY OF EFFICIENT TRANSMISSION AND RECEPTION OF IMAGE-TYPE DATA USING MILLIMETER WAVES Interim Engineering Report
C. Louis Cuccia 15 Mar. 1970 402 p
(Contract NAS12-2186)
(NASA-CR-86412; TR-DA2180) Avail: CFSTI CSCL 17B

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1. THE COMMUNICATION ASPECTS OF IMAGE TRANSMISSION HIGH DATA RATE 9 p (See N70-32121 17-07)
2. COMMUNICATION SYSTEM ASPECTS OF HIGH-DATA RATE IMAGERY TRANSMISSION 37 p (See N70-32122 17-07)
3. IMAGE SENSOR TECHNOLOGY 67 p (See N70-32123 17-07)
4. DIGITAL TRANSMISSION OF IMAGERY DATA 48 p (See N70-32124 17-07)
5. MODULATOR/DEMODULATORS FOR PSK DIGITAL DATA SYSTEMS 103 p (See N70-32125 17-07)
6. ACQUISITION, SEARCH, TRACK 47 p (See N70-32126 17-30)
7. THE MILLIMETER WAVE LINK 51 p (See N70-32127 17-07)

N70-32121*# Philco-Ford Corp., Palo Alto, Calif.
THE COMMUNICATION ASPECTS OF IMAGE TRANSMISSION HIGH DATA RATE
In its Study of Efficient Transmission and Reception of Image-Type Data Using Millimeter Waves 15 Mar. 1970 9 p (See N70-32120 17-07)
Avail: CFSTI CSCL 17B

Satellite relay systems and communication subsystems for image data communication using millimeter wave relay satellites are specified. Communication subsystems are: (1) a sensor complex which translates optical or radiometric image data into an analog electrical signal which is communicated to a display and recording system; (2) analog to digital and digital to analog converters; (3) modulator and demodulator systems; and (4) the millimeter wave link. E.C.

N70-32122*# Philco-Ford Corp., Palo Alto, Calif.
COMMUNICATION SYSTEM ASPECTS OF HIGH-DATA RATE IMAGERY TRANSMISSION
In its Study of Efficient Transmission and Reception of Image-Type Data Using Millimeter Waves 15 Mar. 1970 37 p (See N70-32120 17-07)
Avail: CFSTI CSCL 17B

Binary and M-ary digital techniques are discussed. Analog and digital modulation and transmission techniques are compared as well as modulation at 40 to 400 Mbps rates. Phase shift keying and delta modulation analog to digital conversion is the recommended technique. Candidate frequency bands for high data rate image transmission are cited. E.C.

N70-32123*# Philco-Ford Corp., Palo Alto, Calif.
IMAGE SENSOR TECHNOLOGY
In its Study of Efficient Transmission and Reception of Image-type Data Using Millimeter Waves 15 Mar. 1970 67 p (See N70-32120 17-07)
Avail: CFSTI CSCL 17B

Modulation transfer function, video bandwidth, and signal to noise ratio aspects of an image sensor system are discussed. Wideband recording techniques are reviewed. E.C.

N70-32124*# Philco-Ford Corp., Palo Alto, Calif.
DIGITAL TRANSMISSION OF IMAGERY DATA
In its Study of Efficient Transmission and Reception of Image-Type Data Using Millimeter Waves 15 Mar. 1970 48 p (See N70-32120 17-07)
Avail: CFSTI CSCL 17B

The technology of the conversion of analog video data information to a digital bit stream, and its reconversion back to analog data is discussed. The circuits, approaches and problems which relate to 40 to 400 Mbps are specificially addressed. High data rate A/D conversion approaches are identified and discussed. Emphasis is placed on delta modulation and its application to imagery data transmission. Author

N70-32125*# Philco-Ford Corp., Palo Alto, Calif.
MODULATOR/DEMODULATORS FOR PSK DIGITAL DATA SYSTEMS
In its Study of Efficient Transmission and Reception of Image-Type Data Using Millimeter Waves 15 Mar. 1970 103 p (See N70-32120 17-07)
Avail: CFSTI CSCL 17B

The data rates of 40 to 400 Mbps which are being addressed in this study are most efficiently served by phase-shift-keying techniques in order to conserve bandwidth and to take advantage of simplified transmitter and receiver techniques which are inherent in phase-shift-keying systems. Biphase and quadriphase modulator systems are described. Author

N70-32127*# Philco-Ford Corp., Palo Alto, Calif.
THE MILLIMETER WAVE LINK
In its Study of Efficient Transmission and Reception of Image-Type Data Using Millimeter Waves 15 Mar. 1970 51 p (See N70-32120 17-07)
Avail: CFSTI CSCL 17B

The millimeter wave link determines the amount of margin required to transmit a given information data rate at a particular frequency over a given distance. Of prime importance are: transmitter power, transmitter antenna gain, space loss, receiving antenna gain, and receiving system noise figure. These parameters are addressed with particular reference to problems in transmitting data at 40 to 400 Mbps at millimeter wave frequencies from 35 to 90 GHz. Author

N70-32149# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
SYSTEM DESIGN CONSIDERATIONS FOR A WIDEBAND FM FEEDBACK DEMODULATOR FOR USE IN MULTIPLEX VOICE APPLICATIONS
J. W. Bayless and Someshwar C. Gupta 1969 7 p refs
(Contract F44620-68-C-0023)
(AD-704143; AFOSR-70-0950TR) Avail: CFSTI CSCL 17/2.1

The paper considers system design criteria for an FM feedback receiver capable of demodulating wideband multiplex voice signals. Threshold extension is related to the loop gain and IF filter parameters. For multiplex voice channels, a design procedure is derived. Author (TAB)

N70-32180# Institute For Telecommunication Sciences, Boulder, Colo.
TECHNIQUE FOR IMPROVING THE ACCURACY OF AIR-TO-GROUND RADIO DISTANCE MEASUREMENT SYSTEMS
L. E. Wood and M. C. Thompson, Jr. Mar. 1969 33 p refs
(ESSA-TR-ERL-108-ITS-76) Avail: SOD $0.40

A subsystem is described that can be added to existing radio distance measuring systems, such as SHIRAN, to increase the accuracy. The modification gives the accuracy characteristics of optical ranging systems but requires light transmission in only one direction over the path being measured. The optical subsystem can be used as seeing conditions permit, and when it cannot be used the radio system performance is not affected. Available components and technology indicate operational ranges up to several hundred kilometers. Author

N70-32200# British Broadcasting Corp., Kingswood (England). Engineering Div.
FIELD-STORE STANDARDS CONVERSION: SERVO-CONTROL OF THE FIELD DELAY
1970 9 p refs
(BBC-1970/16; EL-39) Avail: CFSTI

A servocontrol system is described which maintains the duration of a field delay equal to the field duration of the applied television signal. Errors in delay are corrected by binary-related lengths of coaxial cable which are switched into or out of circuit, as required. Since the range of control is insufficient using practical lengths of cable, several quartz delays are also included to accommodate larger errors. Delay errors are detected by comparing the timing of line synchronizing pulses at the input and output of the delay and adjustments are made in steps of 9ns. Author

N70-32234# Advisory Group for Aerospace Research and Development, Paris (France).
A SURVEY OF SCINTILLATION DATA AND ITS RELATIONSHIP TO SATELLITE COMMUNICATIONS
Aug. 1969 97 p refs
(AGARD-571) Avail: CFSTI

CONTENTS:

1. VHF ATMOSPHERIC STUDIES AND COMMUNICATIONS AND NAVIGATION SYSTEMS J. P. Mullen p 1–2 ref (See N70-32235 17-07)

2. THE DEFINITION OF SCINTILLATION INDEX AND ITS USE FOR CHARACTERIZING IONOSPHERIC EFFECTS H. E. Whitney p 3–11 refs (See N70-32236 17-13)

3. SUMMARY OF PROPERTIES OF F-REGION IRREGULARITIES T. J. Elkins p 13–37 refs (See N70-32237 17-13)

4. APPLICATION OF THE STATISTICS OF IONOSPHERIC SCINTILLATION TO VHF AND UHF SYSTEMS R. S. Allen p 39–53 ref (See N70-32238 17-13)

5. SPECIAL PROBLEMS IN SCINTILLATIONS J. Aarons p 55–88 refs (See N70-32339 17-13)

6. PROPAGATION DELAYS OF VHF WAVES J. A. Klobuchar p 89–92 (See N70-32240 17-07)

N70-32235# Advisory Group for Aerospace Research and Development, Paris (France).
VHF ATMOSPHERIC STUDIES AND COMMUNICATIONS AND NAVIGATION SYSTEMS
John P. Mullen *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 1–2 ref (See N70-32234 17-07)
Avail: CFSTI

The use of communication satellites for onboard navigation, and air traffic control over the North Atlantic are discussed. The expected improvement in navigation would increase the number of tracks and permit more nearly optimal crossings resulting in fuel savings. F.O.S.

N70-32240# Advisory Group for Aerospace Research and Development, Paris (France).
PROPAGATION DELAYS OF VHF WAVES
John A. Klobuchar *In its* A Survey of Scintillation Data and Its Relationship to Satellite Commun. Aug. 1969 p 89–92 (See N70-32234 17-07)
Avail: CFSTI

Data showing that the time delay of VHF radio waves traveling through the ionosphere varies as a function of several parameters are presented with the problems in predicitng the time delay. Two methods of determining the time delay of a VHF radio wave are discussed. These are: data from stations are used to construct an analytic model of the time delay along a required path, and the time delay is related to some other ionospheric parameter which is measured and predicted on a world-wide basis. Ionospheric parameters studied are: Faraday effect, total electron content, and elevation angle. F.O.S.

N70-32249# Duke Univ., Durham, N.C. Adaptive Signal Detection Lab.
THE LIKELIHOOD RATIO APPROACH VS A DECISION DIRECTED ESTIMATOR FOR THE DETECTION OF A TRANSIENT SIGNAL OF UNKNOWN AMPLITUDE
Marshall A. Gallop, Jr. (M.S. Thesis) May 1969 72 p refs
(Contract N00014-67-A-0251-0001)
(AD-704172; TR-3) Avail: CFSTI CSCL 20/1

The purpose of this report is to further the theory of signal detectability in underwater acoustics by comparing several approaches to the solution of the problem of detection of transient signals of unknown amplitude in noise. The two approaches given primary consideration are the optimal likelihood ratio approach and a decision-directed approach. The results of this study indicate that if one desires channel gain classification as well as detection performance, and his choice is not limited by receiver complexity or cost, he would probably choose the optimal receiver structure. However, if channel gain classification is not a necessity, and it is desirable to couple good although sub-optimal detection performance with requirements for lesser memory and structural complexity of the receiver, then a reasonable choice is the receiver structure designed for the optimal detection of a transient signal of known amplitude. Author (TAB)

N70-32253# National Aerospace Lab., Tokyo (Japan).
THE ANALYSIS ON TRANSMISSION-LINE ROCKET ANTENNAS
Johji Tabata, Yoshio Sakurai, Masao Miura, Yoshitsugu Matsuzaki, and Norio Tsukamoto Dec. 1969 27 p refs In JAPANESE; ENGLISH summary
(NAL-TR-186) Avail: CFSTI

Transmission-line rocket antennas of low silhouette are analyzed in terms of an approximately equivalent circuit that consists of a shunt-driven transmission line with an open or a short-circuit termination at each end. The theory of impedance matching mechanism of these antennas is developed and it is clarified that several types of these are able to be matched to the expected resistance without any extra matching box. The results of calculation for the characteristics and the performance of the fundamental types of these antennas, including the radiation patterns, the input impedances, several other electrical parameters, and mechanical parameters, are approximately coincident with experimental results. Author

N70-32271*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS SYSTEM RESEARCH
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 25–89 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 17B

Continuing progress is reported on telecommunications systems. The general areas covered include coding synchronization, combinatorial, propagation, multiple access, and permutation investigations. N.E.N.

N70-32272*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS ELEMENTS RESEARCH
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 90–120 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 17B

Research on spacecraft antennas is reported on reflector surface materials, radiation characteristics of Mars rough lander antennas, geometrical optics of dipole fields derived by Wentzell Krammers Brillouin approximation, and optimization criterion for illuminating circular antenna apertures. Systems of frequencies above S-band and an S/X-band experiment are described, and a 10.6 micron heterodyne radiometer was designed for optical communication. N.E.N.

N70-32273*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT RADIO: TOPS RADIO FREQUENCY SUBSYSTEM
A. W. Kermode *In its* Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 121–125 (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 17B

The receivers, transmitters, and operation of the thermoelectric Outer Planet Spacecraft radio frequency subsystem are described. The requirements that are new or different from the previous Mariner are listed and their characteristics of the two subsystems are compared. Estimated reliability data are given for receivers, transmitters, and power supply units. N.E.N.

N70-32274*# Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena.
SPACECRAFT TELECOMMUNICATIONS SYSTEMS: A DIGITAL COMMAND SYSTEM DEVELOPMENT
C. R. Tegnelia *In its* Space Programs Sum. No. 37-61, Vol. 3 18 Feb. 1970 p 126–129 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 17B

The all digital, single channel, command subsystem for future missions is described. A breadboard model was operated and preliminary bit error rate data are given along with simulated subcarrier acquisition data. N.E.N.

N70-32278*# Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena.
APPLIED MECHANICS
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 171–190 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 17B

A numerical optimization technique for space antenna concepts is given. The restructuring of the receptance coupling program RECEP required by the conversion to the Univac 1108 system is described. An analytical approach is applied to the problem of maximum dynamic response of structures. Deformation modes and natural frequencies are obtained for a simple rotating structure with lumped masses. Laser holography techniques are discussed for vibration and deformation measurements. N.E.N.

N70-32321# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECOGNITION OF A LIMITED SET OF SPEECH SIGNALS

T. K. Vintsyuk 28 Jan. 1970 17 p refs Transl. into ENGLISH from Seminar. Raspoznavaniye Obrazov i Konstruir. Chitayushch. Avtomatov (USSR), no. 1, 1966 p 135–149
(AD-704829; FTD-HT-23-363-69) Avail: CFSTI CSCL 17/2

A description is given of the algorithm based on the correlation method of recognition. The following three basic stages are noted: (1) the preparation of a description based on an assumption that the controlling factor in indentification of noises, syllables, and words is the dynamics of the filtering system of the human voice tract; (2) the procedure of training involving the development of standard descriptions of the class; and (3) the procedure of recognition. The criterion of recognition is based on the description of voice signals by means of current weighted autocorrelation functions, on the criterion of the minimum Euclidean space and on the assumption of the statistical model of the description of classes. The results of the experiments conducted on a digital computer are presented. TAB

N70-32431# Army Electronics Command, Fort Monmouth, N.J.
MULTIPATH PROBLEMS IN TRANSMISSION OF 20 KBIT/S DATA VIA THE VHF-FM MEDIA
Thomas M. Seiler Feb. 1970 29 p refs
(AD-704705; ECOM-3241) Avail: CFSTI CSCL 17/2

In an effort to statistically quantify the tactical VHF-FM media for the transmission of 20 kb/s data in the Payson Area of Central Arizona an interesting phenomenon was observed. Severe amplitude and phase distortion was observed on the digital bit stream when the transmitter was moved through some well-defined regions. It is of interest to note that these regions were fairly common but extremely localized and were surrounded by area where practically no distortion was observed. Thus it was possible to be within visual contact of the receiver, be transmitting good data and move a distance of 6 inches and enter a region of severe distortion which would cause receiver to lose bit synchronization. This phenomenon was attributed to multipath since the received level in the distorted region was not significantly different from that observed in the undistorted region. However, the delays of the various signals causing the multipath are postulated to be multiples of the wavelength of the carrier and are on the order of 50 to 100 nanoseconds. This contention is backed up by both physical and mathematical evidence. Author (TAB)

N70-32439# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TELEVISION PROJECTION ON A SUPERICONOSCOPE
A. V. Vykhodets 6 Mar. 1970 17 p refs Transl. into ENGLISH from Teknika Kino i Televideniya (Moscow), no. 6, 1969 p 38–41
(AD-704767; FTD-MT-24-351-69) Avail: CFSTI CSCL 17/2

Considered are the problems of increasing the control efficiency in telecine systems with automatic control of target charge average value. Given are conditions of tuning the system during the transmission of positive and negative films. TAB

N70-32443# Naval Research Lab., Washington, D.C.
THE EFFECT OF LOAD VSWR ON THE PERFORMANCE OF FERRITE PHASE SHIFTERS Interim Report
M. L. Reuss, Jr. 26 Mar. 1970 14 p
(AD-705056; NRL-7029) Avail: CFSTI CSCL 9/5

When the beam of a phased-array antenna is scanned, the power coupled back toward the source from the radiating elements varies in phase and magnitude. This coupled power appears to a phase shifter located between the source and the radiating element as a variable-mismatch termination. When ferrite phase shifters are employed at high peak power levels, an additional complication arises due to the nonlinear loss characteristic of the ferrite material. The report describes the effect of given load mismatches on the performance of three different model S-band ferrite phase shifters as the incident peak power level is varied. Author (TAB)

N70-32461*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
MILLIMETER-WAVELENGTHS PROPAGATION STUDIES Semiannual Status Report
30 Apr. 1970 25 p
(Grant NGR-36-008-080)
(NASA-CR-110649; SASR-2374-4) Avail: CFSTI CSCL 20N

The multiple terminal facility developed for the ATS-E millimeter wave propagation experiment is described. This facility is presently operational. Sample data have been recorded and preliminary analyses have been performed. The current status of the program is reviewed and some discussion of the significance of the data being obtained is included. Author

N70-32465*# Bellcomm, Inc., Washington, D.C.
THE OPTIMUM PHASE DEMODULATOR FOR INTERFERING PM SUBCARRIER SIGNALS
W. D. Wynn 3 Jun. 1970 73 p refs
(Contract NASw-417)
(NASA-CR-110642; TM-70-2034-4) Avail: CFSTI CSCL 17B

The derivation of an optimum demodulator is presented that produces minimum mean square error estimates of interfering subcarrier signals that are phase modulated as a sum on a carrier. These subcarrier signals are interfering in that they overlap in the subcarrier band. The derivation presented is nonconstructive in that no a priori knowledge of the form the demodulator should have is assumed. The approach taken can be applied to find receivers for signals that are more complex than interfering frequency multiplexed FM or PM subcarrier signals. An example is considered where there are two PM subcarrier signals that overlap in the subcarrier band. One has a broadband video spectrum and the other has a narrow bandpass spectrum centered about a subcarrier frequency. The spectra for these subcarrier signals is chosen to simulate the problem of simultaneously demodulating interfering TV and bandpass voice signals. This problem is encountered in the system used to transmit Apollo color TV from moon to earth. Author

N70-32481# Lincoln Lab., Mass. Inst. of Tech., Lexington.
VHF ANTENNA SYSTEM FOR AIRCRAFT
Milton L. Rosenthal 12 Mar. 1970 45 p refs
(Contract AF 19(628)-5167)
(AD-705170; ESD-TR-70-53; TN-1970-8) Avail: CFSTI CSCL 9/5

Presented are the initial results of a theoretical investigation of crossed-slot antenna elements arrayed on an aircraft to provide communications with satellites in the 225 to 400 MHz frequency range. Calculations indicate that two four-element array antennas can approximate the desired performance of covering the hemisphere above the aircraft with more than 6 dB directive gain. Including the polarization loss between the elliptically polarized aircraft antenna and the circularly polarized satellite antenna, coverage is provided over about 90 percent of the desired area. Author (TAB)

N70-32524*# Philco-Ford Corp., Palo Alto, Calif. Western Development Labs. Div.
ANTENNA PATTERN SHAPING, SENSING AND STEERING STUDY Final Report, Dec. 1968 – Nov. 1969
John Savides 9 Jul. 1970 389 p
(Contract NAS3-11525)
(NASA-CR-72629) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 09E

The results of a study for determining the feasibility of multibeam antenna systems for the transmission of high RF power (in the order of 1 KW CW) from geostationary satellites is presented. Conceptual designs are analyzed with respect to generation of multibeam patterns, low sidelobe levels, low RF insertion losses, high power handling capability of microwave components, antenna pointing capability and structural thermal distortions affecting antenna patterns and pointing errors. A conceptual design is described that satisfies the desired requirements and constraints, concluding that such antenna systems are feasible for satellites to be launched in 1975. The hardware technology development efforts required to verify the analytical results are identified. Author

N70-32532*# General Electric Co., Philadelphia, Pa. Space Systems Organization.
GROUND SIGNAL PROCESSING SYSTEMS, SUMMARY REPORTS ON ANALYSIS, DESIGN AND COST ESTIMATING
Jun. 1970 151 p
(Contract NAS3-11520)
(NASA-CR-72709) Avail: CFSTI CSCL 17B

Ground signal processing systems for television satellites was studied. Using present state-of-the-art technology, low-cost signal processing techniques and devices for receiving low-power color television signals from satellites were developed. Special consideration was given to minimizing the complexity and cost of manufacturing and installation while maximizing reliability and maintainability. The practicability of selected techniques was demonstrated by the fabrication of prototype units, which will be tested in television receiving systems. Author

N70-32548 National Lending Library for Science and Technology, Boston Spa (England).
THE RECORDING AND INTERPRETATION OF ECHO SIGNATURES ON A 3 cm TRACKING RADAR [ZUR REGISTRIERUNG UND INTERPRETATION VON ECHOSIGNATUREN AN EINEM 3-cm-ZIELVERFOLGUNGSRADAR]
Bruno Bruderer 26 Jan. 1970 20 p refs Transl. into ENGLISH from der Ornithologische Beobachter (Bern), v. 66, no. 3, Jun. 1969 p 70–80
(NLL-RRE-Trans-252-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Bird flight was studied by using a 3 cm tracking radar with continuous recording capability. The radar equipment and methods for use, and the application of the automatic gain control signal for quantitative bird studies for determining species are discussed. Conclusions are: (1) Recorded signals in conjunction with the measured flight paths and air speeds, allow groups and single birds to be distinguished and undesired echoes to be eliminated. (2) If radar cross sections are measured it is possible to establish wing-beat frequencies, and in conjunction with information on air speed and duration of flapping and gliding phases during flight, to identify bird species. F.O.S.

N70-32602# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES
S. P. Pivovarov et al 19 Mar. 1970 65 p refs Transl. into ENGLISH from Tekhn. Kino Televideniya (Moscow), v. 10, no. 5, 1966 p 7–17, 46–59
(AD-704775; FTD-MT-24-13-70) Avail: CFSTI CSCL 17/2

Contents: Artificial earth satellite television equipment for observing cloudiness; Television observation of rotating objects; Formation of signals of constant component restoration; and High-frequency microphonic interference in image orthicons. TAB

N70-32619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES
P. F. Bratslavets et al 4 Mar. 1970 39 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 10, no. 10, 1966 p 18–23, 53–60
(AD-704774; FTD-MT-24-05-70) Avail: CFSTI CSCL 17/2

Contents: Television equipment for scientific studies of space; LI-414 vidicon with adjustable memory. TAB

N70-32673*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERIAL RF NOISE MEASUREMENT IN URBAN AREAS AT UHF FREQUENCIES
G. Anzic [1970] 13 p refs Presented at the 3d Commun. Satellite System Conf., Los Angeles, 6-8 Apr. 1970; sponsored by AIAA
(NASA-TM-X-52751) Avail: CFSTI CSCL 17B

The results of a combined aerial and ground survey of radiofrequency noise in the Phoenix, Arizona area are presented. The measurements were made at 0.3, 1.0 and 3.0 gigahertz. The task objectives were to determine the correlation between air and ground data and to demonstrate the ability to identify high urban noise areas from aerial data. The RMS noise level and average noise envelope voltage were measured. Ten 3 db step comparators were also used to provide data on noise amplitude distributions, pulse width and frequency of occurrence. The results indicate that an aerial survey can be used to identify high urban noise areas. Ground sites well immersed in noise yielded good correlation with air data and cyclic behavior of noise is easily determined from air data. Author

N70-32684*# Houston Univ., Tex.
TRANSMISSION CHARACTERISTICS OF SPLIT-PHASE PCM CODES, PART 1 Final Report
N. M. Shehadeh and Ran-Fun Chiu 11 Mar. 1970 66 p refs
(Contract NAS9-9270)
(NASA-CR-108450) Avail: CFSTI CSCL 09F

Certain transmission characteristics of a carrier which is amplitude-shift-keyed (ASK), phase-shift-keyed (PSK), or frequency-shift-keyed (FSK) by a split-phase PCM code were determined. Specifically, the power spectral density was determined for each modulation scheme. All calculations assume a random bit pattern with equally likely ones and zeros. Author

N70-32802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA FILTERING FOR THE NEW MINITRACK SYSTEM
V. R. Simas and D. E. Santarpia May 1970 18 p refs
(NASA-TM-X-63958; X-523-70-207) Avail: CFSTI CSCL 17B

Data filtering for the Minitrack system is discussed. Narrowband predetection filtering is required to avoid deterioration of the signal to noise ratio by the signal detector. The minimum passband, set by Doppler and other frequency uncertainties, is 7 KHz. Electronic post-detection filtering and data smoothing by polynomial fitting are equivalent, providing sufficient data samples are supplied. The tracking filter is selected which can follow, with negligible error, the first, second, and third derivatives of the signal phase resulting from a worst case spacecraft pass of 100 miles altitude directly over the station. Author

N70-32824*# Techtran Corp., Glen Burnie, Md.
SSB-PM AND PCM.PM-FT SATELLITE COMMUNICATION SYSTEMS COMPARISON

Syuntaro Niwa Washington NASA Dec. 1969 15 p Transl. into ENGLISH from Rev. of the Radio Res. Labs. (Japan), v. 15, no. 76, Jan. 1969 p 1–15
(Contract NASw-1695)
(NASA-TT-F-12384) Avail: CFSTI CSCL 17B

A comparison of satellite multiple access communication systems is presented. Single side band-pulse modulation and pulse code modulation systems are considered. The basis for comparison of the systems is: (1) channel accomodation capacity, (2) channel network composition flexibility, (3) adaptability to coexistence of participating stations of different scales, (4) adaptability of access external communication networks, and (5) adaptability to future channel increases. Author

N70-32902# Joint Publications Research Service, Washington, D.C.
STUB AND FRAME ANTENNAS FOR FLIGHT VEHICLES
G. B. Reznikov 9 Jun. 1970 24 p Transl. into ENGLISH from the publ. "Antenny Letaielnykh Apparatov," Chapter 7 Moscow, 1967 p 274–295
(JPRS-50690) Avail: CFSTI

Stub and frame antennas are considered in terms of installation and principles of action. Emphasis is placed on the calculation and experimental investigation of the input impedance of the stub antenna. Formulas are given for the determination of the radiation field and the Poynting vector in the wave zone. J.M.C.

N70-32909*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WORLDWIDE VHF SATELLITE SCINTILLATION/FADING TESTS: ATS PROJECT
Apr. 1970 32 p refs
(NASA-TM-X-63957; X-460-70-127) Avail: CFSTI CSCL 20N

On November 11, and December 2, 9, 16, and 23, 1969, several stations throughout the world monitored the VHF telemetry signals from ATS 1, ATS 3, and ATS 5 in an attempt to characterize the effects of the ionosphere on propagation of VHF signals through the ionosphere. These tests under the sponsorship of NASA were the first in a series to be continued during the solar eclipse period in March 1970. The simultaneous participation of many stations permits identifying the effects of station location, satellite elevation angle, and diurnal effects. Graphical summaries are presented for each station. Author

N70-32928*# Stanford Univ., Calif. Radioscience Lab.
EXPERIMENTS CO2 (OGO 2) AND D02 (OGO 4) Final Report, 2 Nov. 1962 – 31 Jul. 1969
R. A. Helliwell and J. J. Angerami 31 Jul. 1969 109 p refs
(Contract NAS5-3093)
(NASA-CR-110658) Avail: CFSTI CSCL 20N

The main results are summarized of the research data from the experiments flown on OGO 2 and OGO 4 to make VLF measurements on propagation and wave-particle interactions in the magnetosphere and ionosphere, and to survey the ionospheric noise in a range of frequencies from 200 Hz to 100 kHz. The orbits and attitudes of both satellites, and the main features of the experiments are briefly described, and the calibration curves of the corresponding receivers are given. A concise account of the results obtained to date on each of several topics is given, and illustrated abstracts of work in progress are included. Author

N70-32929*# ADCOM, Inc., Cambridge, Mass.
CHARACTERIZATION OF CAUSES OF SIGNAL PHASE AND FREQUENCY INSTABILITY Final Report
Elie J. Baghdady and Southard Lippincott 8 Jan. 1970 114 p refs
(Contract NAS2-5337)
(NASA-CR-73442; G-150F) Avail: CFSTI CSCL 09E

Identified and characterized are the causes of signal phase and frequency instability whose measurement is facilitated by the use of equipment called the Oscillator Instability Measurement System (OIMS). The study includes the necessary measurements to be made on the Pioneer E spacecraft and at station receivers in order to allow separate identification of phase and frequency instability caused by the following phenomena: (1) spacecraft oscillator; (2) atmospheric multipath; (3) scatter by atmospheric turbulence; (4) fluctuations in time-variant spatial mean of the index of refraction; and (5) DSS receiver under strong and noisy signal conditions. Author

N70-32956# Illinois Univ., Urbana. Dept. of Electrical Engineering.
ON THE MINIMUM DISTANCE STRUCTURE OF CYCLIC CODES AND DECODING BEYOND THE BCH BOUND
Carlos Ricardo Peixoto Hartmann Feb. 1970 87 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-2339)
(AD-702901; Rept-R-458) Avail: CFSTI CSCL 9/4

Two related aspects of cyclic codes have been investigated. An attempt has been made to obtain a better understanding concerning their minimum distance, and to find decoding methods to decode beyond the BCH bound. A theory is presented which enables one to obtain better bounds for the minimum distance of a large number of nonprimitive BCH codes. The derivation of this new theory is based on the use of more than one set of consecutive roots of the generator polynomial. The new results are easily applicable since they are based, as the BCH bound, on the pattern of the roots of the generator polynomial. A general decoding method to decode beyond the BCH bound is outlined. In addition a decoding method to decode beyond the BCH bound codes with minimum distance greater than the BCH bound and with multiple sets of consecutive roots is introduced. Author (TAB)

N70-33014# Radio Corp. of America, Moorestown, N.J. Defense Electronic Products.
AN/PPS-() ULTRA RELIABLE RADAR Interim Development Report, 3 Nov. 1969 – 3 Mar. 1970
J. D. Frattura 3 Mar. 1970 107 p
(Contract N00039-70-C-3502)
(AD-704150) Avail: CFSTI CSCL 17/9

The program covers the study, design, construction, test, analysis and inspection of a complete and operative, highly reliable, relatively failure-free version of the pulsed doppler surveillance AN/PPS-6 radar set. The radar set is intended to be a lightweight, miniaturized, X-Band, pulsed doppler combat surveillance radar. The basic purpose of this program is to develop a highly reliable radar set considering the overall cost of ownership when development, production and maintenance costs are taken into account while keeping the same general performance, form-factor and weight as the AN/PPS-6 radar. Author (TAB)

N70-33040# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
DIFFRACTION ANALYSIS OF SCATTERING BY A CUBE WITH APPLICATION TO THE TIME RESPONSE WAVEFORMS
C. E. Ryan, Jr. 13 Mar. 1970 49 p refs
(Contract F19628-67-C-0239)
(AD-702874; OSURF-2415-3; AFCRL-69-0490; SR-4) Avail: CFSTI CSCL 20/14

The geometrical theory of diffraction has been applied to analysis of the backscattered fields of a cube in the plane normal

to four edges of the cube. Cylindrical wave diffraction is assumed to obtain the second order interactions between edges. A normalization factor is developed to obtain the absolute magnitude of the diffracted field in three dimensions. The results of this diffraction analysis are used to calculate the backscattered fields at harmonically related frequencies which are then combined with experimental data and transformed to obtain impulse, ramp and step responses in the time domain. The impulse, ramp and step responses for vertical and horizontal polarization are presented for theta = 0 deg (specular direction), 15, 30 and 45 deg. Author (TAB)

N70-33156*# Stanford Univ., Calif. Radioscience Lab.
EXPERIMENTS A17 (OGO 1) AND B17 (OGO 3) Final Report, 16 Feb. 1962 - 30 Jun. 1968
R. A. Helliwell 30 Jun. 1968 81 p refs
(Contract NAS5-2131)
(NASA-CR-110716) Avail: CFSTI CSCL 12B

The main results of the research data from the VLF experiments flown on OGO 1 (A 17) and OGO 3 (B 17) are summarized. The orbits and attitudes of both satellites are briefly described, and the main features of the VLF experiments A 17 and B17 are presented. The calibration curves of the corresponding receivers are given, along with a concise account of the results obtained to date in each of several topics. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-32028*# Texas Univ., Austin. Dept. of Electrical Engineering.
SENSITIVITY ALGORITHMS FOR DIMENSIONAL STRUCTURE ERRORS IN THE KALMAN ESTIMATOR
D. G. Lainiotis and M. R. Ralley [1970] 24 p refs
(Grants NGR-44-012-066; AF-AFOSR-67-0766E; AF-AFOSR-69-1764)
(NASA-CR-110510; AD-701426; AFOSR-70-0393TR) Avail: CFSTI CSCL 09D

The performance algorithms of the Kalman estimators are derived when the dimensionality of the estimators differs from that of the actual system model. The estimators considered are the continuous and discrete-time cases of the Kalman filter, predictor and fixed-interval smoother. These performance algorithms represent the structural sensitivity resulting when the system performance is lowered due to errors in the order of the differential (difference) equation that describes the system. Author (TAB)

N70-32029# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ORGANIZATION OF THE WAITING DISCIPLINE IN MASS-SERVICING SYSTEMS USING THE MODEL OF THE COLLECTIVE RESPONSE OF AUTOMATA
V. I. Varshavskii et al 26 Mar. 1970 12 p refs Transl. into ENGLISH from Probl. Peredachi Inform. (Moscow), v. 4, no. 1, 1968 p 73-76
(AD-705161; FTD-HT-23-94-70) Avail: CFSTI CSCL 9/2

A mass-servicing system with waiting is examined. The ingoing Poisson flows have various representative service times. A system of priorities has been organized without interruption directly in channels without the a priori knowledge of the characteristics of the input flows. The results obtained by simulation on a digital computer show that the quality of the proposed systems functioning is asymptotically adequately close to the quality of the functioning of a system with priorities whose probability characteristics are known a priori. Author (TAB)

N70-32030# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORK Quarterly Technical Report, 1 Jan.-31 Mar. 1970
Frank E. Heart Apr. 1970 16 p
(Contract DAHC15-69-C-0179; ARPA Order 1260)
(AD-705118; BBN-1966; QTR-5) Avail: CFSTI CSCL 9/2

The basic function of the IMP computer network is to allow large existing time-shared (Host) computers with different system configurations to communicate with each other. Each IMP (Interface Message Processor) computer accepts messages for its Host from other Host computers and transmits messages from its Host to other Hosts. Since there will not always be a direct link between two Hosts that wish to communicate, individual IMPs will, from time to time, perform the function of transferring a message between Hosts that are not directly connected. This then leads to the two basic IMP configurations - interfacing between Host computers and acting as a message switcher in the IMP network. TAB

N70-32034# Mitre Corp., Bedford, Mass.
MICROPROGRAMMING PROJECT: YEAR END REPORT
Barbara J. Huberman May 1970 25 p refs
(Contract F19628-68-C-0365)
(AD-704891; MTR-1747; ESD-TR-70-122) Avail: CFSTI CSCL 9/2

The title of the project is C3 Computer Organization. It is an ESD/MITRE computer technology project, initiated to support ESD in the area of development and acquisition of large-scale computer systems. Therefore, a more specific goal of the project has been investigation of microprogramming as a technique for creating an environment in which experimental hardware and software can be modeled and evaluated. TAB

N70-32088# National Bureau of Standards, Washington, D.C. Office of Standard Reference Data.
EDIT-INSERTION PROGRAMS FOR AUTOMATIC TYPESETTING OF COMPUTER PRINTOUT
Carla G. Messina and Joseph Hilsenrath Apr. 1970 51 p refs
(NBS-TN-500) Avail: SOD $0.60 Catalog No. C13.46:500

SETLST and KWIND are FORTRAN programs which accept a card deck or Fortran records on magnetic tape and insert the appropriate flags and shift symbols required by many of the standard typesetting programs associated with phototypesetting devices. The programs are specialized to the particular application; the typesetting device and associated programs; and to the desired typeface, by means of control cards and substitution tables supplied at run time. Examples are shown of applications to program listings, KWIC indexes, and normal computer output. When the input is in tabular form, the program permits more sophisticated operations including rearrangement, removal of trailing blanks, typeface changes between columns, etc. These programs can handle any records which can be read by a FORTRAN READ statement under an A format control. Author

N70-32137# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
STEADY STATE AND TRANSIENT ANALYSIS OF A DIGITAL BIT-SYNCHRONIZATION PHASE LOCKED LOOP
James R. Cessna Apr. 1970 7 p refs
(Contract N00014-68-A-0198-0003)
(AD-705007; Rept-70-16) Avail: CFSTI CSCL 9/4

A digital bit-synchronization phase-locked loop employing binary phase error quantization and sequential loop filtering is described. Steady state and transient performance is analyzed in the presence of white Gaussian noise. Bit error rates and effective loop bandwidths are also given. Author (TAB)

N70-32173# Elliott Flight Automation, Ltd., Rochester (England). Automatic Test Equipment Div.
THE SPECIFICATIONS OF THE COMPUTER FOR ATE
J. A. Hill *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 9 p (See N70-32151 17-14)
Avail: CFSTI

Specifications for the computer for the automatic test equipment are considered with emphasis on the following features: work length and structure; instruction code and format; addressing system; register system; core store size and performance; input-output system; and special features of both hardware and software. Author

N70-32186*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEW, VOLUME 3, NO. 9: COMPUTATIONAL RESEARCH
1969 165 p refs
(NASA-TM-X-53962) Avail: CFSTI CSCL 09B

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N70-32187*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MEMORY REDUCTION THROUGH HIGHER LEVEL LANGUAGE HARDWARE
H. Kerner and L. Gellman *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 1–13 refs (See N70-32186 17-08)
Avail: CFSTI CSCL 09B

Traditional assignment of computer functions to logic and memory are evaluated based on trends in their cost and mission characteristics. The higher information content of a higher level language is exploited for the savings of memory. An instruction set was selected from the directly executable statements of FORTRAN, and the remaining statements were identified for compilation. Programs written in this language occupied 75 percent less memory than those obtained by compilation. A computer for the execution of the selected FORTRAN statements was functionally designed in order to estimate the corresponding logic hardware effort. The tradeoff between costs saved through memory reduction and expenditures for the additional logic hardware considered development, manufacturing, power, and weight costs. The proposed concept shows a cost advantage for missions with a high weight penalty and large memory requirements. Another advantage is the higher execution speed inherent in this organization. Author

N70-32188*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FUNCTIONAL DESIGN CONSIDERATIONS FOR AN EXECUTIVE SYSTEM FOR A GENERAL PURPOSE SPACEBORNE COMPUTER
J. R. Kennedy *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 15–27 refs (See N70-32186 17-08)
Avail: CFSTI CSCL 09B

An overview to spaceborne computer requirements for general purpose application in advanced missions is discussed. An approach to a functional design for an executive system that satisfies these gross requirements is presented from an organizational viewpoint with no consideration given to implementation. The level of detail brings out the feasibility aspects of communications, task routing, application command and control, organizational modularity, and mission schedule interpretation. Author

N70-32189*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PARALLEL PROCESSING METHODS AND MANNED SPACE MISSIONS
M. E. Stegenga *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 29–37 refs (See N70-32186 17-08)
Avail: CFSTI CSCL 09B

Parallel processing began with the introduction of Solomon in 1959. The use of this concept has continued in such computers as the Univac 1108, CDC 6600, Illiac IV, and modern Fast Fourier Transform computers. Parallel processing concepts and designs were identified to determine which were applicable to a computer for a manned space mission. For example, image processing could be accomplished much faster by having several processors processing protions of an image than by having any one processor processing the image. A parallel processing computer is one capable of simultaneously executing two or more instruction streams. Author

N70-32190*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTIMIZATION OF AN INSTRUCTION SET FOR A GENERAL PURPOSE SPACEBORNE COMPUTER
J. R. Kennedy *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 39–55 (See N70-32186 17-08)
Avail: CFSTI CSCL 09B

The problem is structured as follows: (1) Given a set of functional registers and a feasible conjectured instruction format, a basic instruction set is developed to perform the general purpose

functions of control including: register load and store, register content logical manipulation, register content arithmetic, instruction sequence routing, procedure linkage, and general control. (2) Analyze the set developed in step 1 with the objective of improving memory utilization (efficiency) both in main core memory and read-only-memory. (3) Consider data precision requirements, and adjust the main memory word size (bus width) to optimize manipulation of both data and instructions. (4) Specify the resulting preferred instruction set and formats, data formats, and affected data routing schemes. Author

N70-32191*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EFFICIENCY AND QUEUEING TIME CALCULATIONS FOR COMPUTER BANKS

B. G. Grunebaum *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 57–64 refs (See N70-32186 17-08)

Avail: CFSTI CSCL 09B

The behavior of a set of computers connected in parallel to a queueing memory and fed by a probabilistic or rather stochastic sequence of programs is described mathematically. Possible underlying hypotheses are discussed and the ones that appear to be most practical from the standpoint of the system designer are used as the basis of closed analytical solutions for the calculation of the design parameters. Some specialized numerical procedures are indicated. Expectable variations of the basic problem and the mathematical modifications and/or additions that they imply are briefly discussed to show the applicability of these techniques in the design of more complex systems. Author

N70-32192*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

APPLICATION OF DISCRETE DIGITAL SIMULATION LANGUAGES TO THE DESIGN OF ADAPTIVE DATA BUFFERING STRATEGIES

L. K. Paul, Jr. *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 65–69 refs (See N70-32186 17-08)

Avail: CFSTI CSCL 09B

Some of the design problems of computer-information networks are briefly discussed, with special reference to the anticipated requirements of a space-station/space-base system. The application of digital simulation techniques to the characterization of computer-information networks is described. Preliminary results of the discrete simulation of a data buffering scheme are presented. Author

N70-32193*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AUTOMATIC MALFUNCTION ANALYSIS (AMA) FOR DISCRETE SYSTEMS

D. T. Thomas and R. L. Jaegly *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 71–84 (See N70-32186 17-08)

Avail: CFSTI CSCL 09B

The hardware configuration that is presently being used to further test automatic malfunction analysis is illustrated. The analytical techniques involve the following basic steps: Prepare a model describing the network or system using logic or Boolean equations. Analyze the equations to establish the interrelationships of the model. Simulate real-time operation of the system using test procedures. Using simulation, establish the system state at each point where analysis is to be made. Analyze the system for each indicator to determine possible failure candidates. Format data for display. The total process including preprocessor, simulation, and automatic malfunction analysis programs are covered. Author

N70-32194*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MARSYAS: A SOFTWARE SYSTEM FOR THE DIGITAL SIMULATION OF PHYSICAL SYSTEMS

H. Trauboth and N. Prasad *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 85–103 refs (See N70-32186 17-08)

Avail: CFSTI CSCL 09B

The physical systems are modeled in the form of block diagrams. The blocks can have multiple inputs and multiple outputs, and a block can contain other blocks within itself; i.e., block diagrams can be built in hierarchies. The block diagram contains analog computer elements, transfer functions, algebraic equations, and logical functions. Elements of the block diagram that are used frequently are available in a Standard Elements List. This list is not fixed; it can be updated easily. For infrequently used elements a FORTRAN subroutine is submitted. MARSYAS also serves as a storage and retrieval system, and for models as a basis for a model configuration control system on the central time-shared computer, UNIVAC 1108. Author

N70-32195*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

REAL-TIME SPACE VEHICLE AND GROUND SUPPORT SYSTEMS: SOFTWARE SIMULATOR FOR LAUNCH PROGRAMS CHECKOUT

H. Trauboth, C. O. Rigby, and P. Brown *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 105–129 refs (See N70-32186 17-08)

Avail: CFSTI CSCL 09B

The objective of this development program is to find a way to perform major functions of the Saturn V Breadboard with a more flexible digital computer, so that launch computer programs can be checked out, test programs can be evaluated, and the effects of malfunctions can be investigated without possible damaging effects on the expensive hardware systems under test. The launch computers send out sequences of discrete stimuli controlled by actual test programs, and the simulator responds in real-time by generating timely discrete and analog signals. The software is designed in such a way that no reprogramming is necessary when a configuration other than the Saturn V has to be simulated, as long as the hardware functions can be described by the same nomenclature for the data base. Author

N70-32196*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

STATE VARIABLE DESCRIPTOR SYSTEM (SVDS)

N. F. Geer *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 131–142 refs (See N70-32186 17-08)

Avail: CFSTI CSCL 09B

A digital computer program, State Variable Descriptor System (SVDS), has been developed for reducing the system block diagram of a dynamic system to a state variable description. Programs are also available that utilize the output of SVDS to perform particular types of analyses. The SVDS is intended to be used on systems with a number of time-invariant elements and a large number of integrators. However, the system being analyzed can contain time-varying and nonlinear elements. SVDS was designed for and implemented on remote time-sharing terminals and is intended for use by those persons familiar with state variable types of analyses. For a full utilization of SVDS, the user should have some knowledge of FORTRAN. Author

N70-32197*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

STORAGE SCOPE GRAPHICS AND EXPERIMENTAL APPLICATIONS

R. Seitz *In its* Res. Achievements Rev., Vol. 3, No. 9 1969 p 143–151 (See N70-32186 17-08)
Avail: CFSTI CSCL 09B

These graphic displays suffice for a number of applications within NASA such as computer-aided design, engineering simulation, and management information display. This display consoles under investigation utilize one or two Tektronix 611 storage display scopes, a pushbutton keyboard, and an electronic interface. They may or may not include a selectric typewriter, a graphical input device, and, when it becomes available, a photostatic copier. Another option that may be available soon is a high speed acoustic telephone coupler. This would permit the Tektronix terminal to communicate with a computer through any standard telephone receiver, thereby rendering the graphics station truly portable. A prototype version of such a display unit is included. Author

N70-32202# Illinois Univ., Urbana. Coordinated Science Lab.
PATTERN CLASSIFICATION WITH A PARTITIONED TRAINING SET
James Cheh-Min Chow Apr. 1970 36 p refs
(Contracts DAAB07-67-C-0199; OE-C-1-7-071213-4557)
(AD-704651; R-463; UILU-ENG-70-208) Avail: CFSTI CSCL 9/2

Pattern classification can be considered as consisting of two parts: (1) Pattern detection - The process of learning from a set of sample patterns of known classifications and discriminating characteristics of each category; and (2) Actual classification - The process of recognizing patterns of unknown classifications as members of particular categories. The paper is a study in the first part of the process since it is most often te more important part of any pattern classification scheme. An algorithm for establishing decision criteria of classification is described. Evaluation is made on its performance, computation time and data storage requirement. Author (TAB)

N70-32203# Western Reserve Electronics, Inc., Cleveland, Ohio.
DEVELOPMENT OF CABLE TEST SET FOR CABLE CX-4566()/G AND CX-4760()/G Final Report, 10 Jul. 1968–10 Aug. 1969
Clarence J. Harsa Mary 1970 11 p
(Contract DAAB07-67-C-0390)
(AD-704697; ECOM-0390-F) Avail: CFSTI CSCL 9/1

The report presents the results of the development effort in the two phase design and fabrication of Cable Test Set for Cable CX-4566()/G. The purpose of the work performed was to design and develop a rugged, portable, lightweight cable test set for military use. The test set will be capable of testing the loop resistance of each individual pair of conductors in addition to performing insulation resistance measurements to detect short circuit and/or intermittent shorts, between individual conductors in each pair, between each pair of conductors and all other pairs, and between each pair of conductors and the cable shielding. Author (TAB)

N70-32222# Stanford Research Inst., Menlo Park, Calif.
THE THEORY AND PRACTICE OF DIGITAL SYSTEMS Final Report, 1968
Bernard Elspas Jan. 1970 56 p refs
(Contract F44620-69-C-0012)
(AD-703747; AFOSR-70-0867TR) Avail: CFSTI CSCL 9/2

The report summarizes the activities of a workshop on relationships between theory and practice for digital systems. Problem areas that were covered in the workshop include problems of parallelism, complexity of algorithms, graph algorithms, hardware and software design problems in digital systems, hardware-software interaction problems, formal languages, and linear sequential machines. A large number of specific problems formulated in these areas are included in the report. Some recommendations are given for future research that may bridge the significant gaps between theory and practice in digital systems. Author (TAB)

N70-32262 National Bureau of Standards, Washington, D.C. Center for Computer Sciences and Technology.
RESEARCH AND DEVELOPMENT IN THE COMPUTER AND INFORMATION SCIENCES. VOLUME 1: INFORMATION ACQUISITION, SENSING, AND INPUT, A SELECTIVE LITERATURE REVIEW
Mary Elizabeth Stevens Mar. 1970 172 p refs
(NBS-Monograph-113-Vol-1) Avail: SOD $1.50 Catalog No. C-13.44: 113/vol-1

The operations of information acquisition, sensing, and input to information processing systems are considered. Topics include: source data automation and remote sensing techniques, communication systems and data transmission links, audio and graphic inputs, preprocessing operations upon input items such as image enhancement and property filtering, character recognition, speech recognition, and other aspects of automatic pattern recognition. Supplemental notes and a bibliography of over 640 references are included. Author

N70-32263# National Bureau of Standards, Washington, D.C. Center For Computer Sciences and Technology.
RESEARCH AND DEVELOPMENT IN THE COMPUTER AND INFORMATION SCIENCES. VOLUME 2: PROCESSING, STORAGE, AND OUTPUT REQUIREMENTS IN INFORMATION PROCESSING SYSTEMS, A SELECTIVE LITERATURE REVIEW
Mary Elizabeth Stevens May 1970 130 p refs
(NBS-Monograph-11-Vol-2) Avail: SOD $1.25

Emphasis is placed on multiple-access systems. Problems of system management and control are discussed, including hierarchies of storage levels. Facsimile, digital, and mass random access storage media and techniques are considered. Output mode requirements are also considered, including direct recording to microforms; on-line display systems; printing, photocomposition, and automatic character generation; and three-dimensional color, and other special-purpose display systems. Problems of system use and evaluation are also briefly noted. A bibliography of approximately 480 references is included, together with supplemental notes and quotations from the literature. Author

N70-32284# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
FEATURE EXTRACTION IN PATTERN RECOGNITION
J. B. Mc Ferran May 1970 262 p refs
(Grant NSF GK-1970)
(TR-EE70-19) Avail: Issuing Activity

Feature extraction of patterns previously stored in magnetic memory is undertaken using a raster scan composed of overlapping horizontal sweeps. The concept of a finite state machine, superimposed upon this framework, resulting in a state diagram with broad general powers of pictorial analysis is reviewed. Equipment consisting of a vidicon scanner and a small general purpose computer with appropriate interconnection was assembled for examination of binary (gray scale) patterns. The global feature extraction is accomplished by means of separate coloring symbols applied to topologically distinct regions of the pattern, while the local feature extraction consists of measurement sets and feature designators. Author

N70-32322# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIENCE WITH THE DESIGN AND OPERATION OF ANALOG-DIGITAL COMPUTING COMPLEXES BASED ON SMALL, MEDIUM, AND LARGE DIGITAL COMPUTERS
V. S. Balakirev et al 4 Mar. 1970 12 p Transl. into ENGLISH from the publ. "Sredstva Analogovoy i Analogo-Tsifrovoy Vychislitelnoy Tekhniki" Moscow, Izd. Mashinostr., 1968 p 175–179
(AD-704831; FTD-HT-23-84-70) Avail: CFSTI CSCL 9/2

Three versions of an analog-digital system (ADS) based on the Ural-1, Dnepr, and M-20 digital computers were hooked up and tested. The MPT-9, MN-M, MNB-1 and other analog computers were used. A weak Co60 - source and a radiometer were used as a white-noise generator. Time saving from using the ADS instead of a digital computer was from considerable to nil, depending on the type of problem and skillfullness of load distribution between the DC and AC. Problems tried on the ADS included: linear digital regulators, supervisory-control systems, homogeneous-reaction kinetics, digital control of batchers, and extremal controllers. TAB

N70-32427# RAND Corp., Santa Monica, Calif.
COMPUTER DATA BANKS AND SECURITY CONTROLS
W. H. Ware Mar. 1970 17 p
(AD-703281; P-4329) Avail: CFSTI CSCL 9/2

There is not today an established data bank industry nor are the technical risks of operating computer-based data banks widely understood. Moreover, the financial incentive of the data bank oporator favors the user of the bank rather than the private individual. For these reasons, it is argued that strong government intervention and control is necessary to protect the privacy and reputation of individuals. The state-of-art for information safeguards in computer systems does not permit a handbook approach to the subject; only general principles and guidelines can be stated. Suggestions are made for controls that can protect information within the computer and govern its divulgence to authorized users. Author (TAB)

N70-32428# RAND Corp., Santa Monica, Calif.
SOME INFORMATION PROCESSING IMPLICATIONS OF AIR FORCE SPACE MISSIONS, 1970–1980
Barry W. Boehm Jan. 1970 56 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-703279; RM-6213-PR) Avail: CFSTI CSCL 5/2

Contents: Hardware trends and operational requirements; Most jobs will not have to strain the hardware; On-board computing: software costs; On-board computing: total system costs; Real-time image processing; Image processing considerations; Information processing: Sts innovations; Sts: hardware implications; Sts: software implications; Difficulty of full software certification; Apollo software certification; and Relative importance of software testing. TAB

N70-32434# RAND Corp., Santa Monica, Calif.
AN APPLICATION OF COMPUTER GRAPHICS: THE FAST-VAL GROUND UNIT DEPLOYMENT INPUT SYSTEM
N. D. Cohen Apr. 1970 92 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-705141; RM-6224-PR) Avail: CFSTI CSCL 15/7

The memorandum describes an application of interactive computer graphics to FAST-VAL, a forward air-strike evaluation model. This is the first step towards a completely interactive version of the FAST-VAL system. In particular, the techniques that were developed during the design and implementation of the FAST-VAL Ground Unit Deployment Input System have contributed to a better understanding of the software support required for similar applications. The work described in this Memorandum is directly applicable to computer-based, military modeling or gaming systems that require flexibility, graphic input, display of data, and user interaction. Author (TAB)

N70-32453# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MULTICYCLE MAGNETIC-SEMICONDUCTOR MEMORY AND LOGIC
Ye. A. Gurvits et al 25 Mar. 1970 19 p refs Transl. into ENGLISH from the book 'Sintez Diskretnykh Avtomatov i Upravlyayushchikh Ustroystv' Moscow, Izd-Vo Nauka, 1968 p 48–58
(AD-705119; FTD-HT-23-83-70) Avail: CFSTI CSCL 9/2

Descriptions are given of multiclock frequency memory and logic circuits, based on standardized ferrite-diode and ferrite-transistor elements. These circuits are more economical and have better performance characteristics than systems operating with two clock frequencies. The economy and superior performance of the described systems are primarily due to two factors: (1) multiclock frequency logic can execute operations uniformly; and (2) fewer elements are required in multiclock frequency logic and shift registers (making possible, in a number of cases, greater operating speed). For example, a shift register with 4 clock frequencies (and 4 synchronizing inputs) operates 6 times faster and requires fewer elements than a register with c equals 2 having the same bit capacity. The disadvantage of such a register is that it requires a gate operating at a frequency of 4f, where f is the basic clock frequency. When multiclock frequency registers and logic circuits are combined, an even greater economy in the number of elements used can be achieved. About 10-25 percent fewer elements are required to build a register with a two-stage adder, operating with 4 clock frequencies, than for a comparable ciruict with c equals 2. Author (TAB)

N70-32456*# Martin Marietta Corp., Denver, Colo. Electronics Research Dept.
FORMULATION OF A TELEMETRY COMPUTER PROGRAM Final Report
Keith A. Hill and Robert O. Leighou Feb. 1970 41 p
(Contract NAS8-24017)
(NASA-CR-102676; MCR-70-38) Avail: CFSTI CSCL 09B

An algorithm and a computer program are described that were developed to generate the set equations for the address register of a telemetry programmer. The telemetry programmer is part of an addressable time division multiplexing telemetry system where remote multiplexers send data to the programmer in response to addresses received from the programmer. The basic flow chart and its description, the detailed flow charts, a description of the data input cards, and an explanation of the printout from the computer program. Author

N70-32477*# System Development Corp., Huntsville, Ala. Space Projects.
EXPERIMENT CONTROL AND DATA PROCESSING REQUIREMENTS SPECIFICATION REPORT, PHASE A
Santa Monica, Calif. 15 May 1970 98 p refs
(Contract NAS8-25471)
(NASA-CR-102736; TM-(L)-HU-033/000/00) Avail: CFSTI CSCL 09B

The experiment control and data processing requirements are specified for two candidate experiments for the NASA Manned Space Station. The primary apparatus and experiment protocol is presented for each experiment, and data processing hardware and software requirements for experiment automation are specified. Author

N70-32485# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS REVIEW, VOLUME 4, NO. 3

Wade B. Holland Mar. 1970 57 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-704598; RM-6200-3-PR) Avail: CFSTI CSCL 9/2

Four articles devoted to process control and industrial automation are featured. One summarizes progress in the introduction of automated control systems in 5 Leningrad plants. Another details the use of computerized systems by the Soviet railroad network, including system shortcomings. Of interest are plans for an automated ticketing and seat reservation system. Other articles examine trends in the development of process contol systems, computer selection of specialization curricula in computational mathematics, and use of the computer to simulate experiments in psychology. TAB

N70-32492# Air Force Systems Command Wright-Patterson AFB, Ohio. Foreign Technology Div.
SET OF UNITS FOR CONSTRUCTING ANALOG COMPUTERS
E. S. Kozlov 8 Jan. 1970 22 p refs Transl. into ENGLISH from Tr. Seminara (Kiev), no. 5, 1967 p 285–298
(AD-701987; FTD-MT-24-252-69) Avail: CFSTI CSCL 9/2

A set of units for constructing network-type simulators permits designing from the simplest manual-control simulators to complex automated analog-digital computers. The units required for solving the following types of problems are tabulated: elliptic equations, parabolic equations, 2nd-order nonlinear partial differential equations, parabolic equations with Stefan conditions. TAB

N70-32559*# General Electric Co., Houston, Tex. Apollo Systems.
DESIGN AND DEVELOPMENT OF A PROTOTYPE SYSTEM PERFORMANCE EVALUATION CONSOLE (SPEC) Final Report, Jun. 1969 – May 1970
R. W. Thompson May 1970 63 p refs
(Contract NAS9-9582)
(NASA-CR-108538) Avail: CFSTI CSCL 09B

Developed is an engineering feasibility model which demonstrates the capability of selective data processing and presentation, decision oriented displays, rapid display reconfiguration and variable function entry. The SPEC is a versatile control and display console which provides an efficient man/machine interface between the console operator and the system under test or checkout. This report contains a description of the console and provides an indication of results and conclusions. Author

N70-32579# Oesterreichische Studiengesellsfhaft fuer Atomenergie G.m.b.H., Seibersdorf. Elektronik-Inst.
MANUAL CONTROLLABLE PROGRAM ADJUSTER FOR CAMAC SYSTEM [HANDEINSTELLBARE PROGRAMMSTEUERUNG FUER CAMAC SYSTEM]
H. Halling and W. Egl 1970 7 p refs In GERMAN; ENGLISH summary Submitted for publication
(SGAE-E-16/1970) Avail: CFSTI

For simple automatic programs, for adjusting and optimizing experiments without computer, the CAMAC Manual Control has been developed. This adjustable hardware-programmer delivers the same electrical signals as the output of the PDP8L, thereby enabling the control of up to seven crates. The purpose of the Manual Controller is to have the possibility to write a limited number of single instructions by pushbuttons as well as logical niveaus, e.g., inhibit, initialize, read, write, print etc. The unit also allows an automatic control of the CAMAC Devices by delivering a number of hardware instructions in automatic cycles. Data set by six decade switches are written into the addressed modul register, the contents of registers can be displayed or printed out by a teletype. An array of switches enables the preselection of the addresses of registers to be printed out. Author

N70-32593# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF A STEP-TYPE REGISTER IN CERTAIN RECOGNITION SYSTEMS
V. M. Kirpichnikov et al 16 Oct. 1969 12 p refs Transl. into ENGLISH from Izv. Vysshikh Ucheb. Zavedenii, Elektromekhan. (Novocherkassk), no. 4, 1968 p 444–446
(AD-700409; FTD-MT-24-275-69) Avail: CFSTI CSCL 9/2

Some symbol (character) recognition systems have a group of sensors, in front of which passes every symbol on tape. A buffer-memory step-type register permits increasing the speed of operation of such systems by N times, N being the number of sensors. The register delays the signal by i cycles, where i equals 1,2...., N-the number of steps of the register. There are m identical standard flawless symbols on an endless tape. Recognition produces 1, nonrecognition 0. The signal is transmitted along the register steps. The possibility of using the step-type register in two other recognition systems is mentioned. TAB

N70-32620# Michigan Univ., Ann Arbor.
A PROGRAMMING SYSTEM FOR SIMULATION OF CELLULAR SPACES
Ronald F. Brender Jan. 1970 171 p refs
(Contract DA-49-083-OSA-3050; ARPA Order 716; Proj. Concomp)
(AD-703260; TR-25) Avail: CFSTI CSCL 9/2

Regular networks of similar interacting components constitute an important class of models in many disciplines, from automata theory to parallel computer systems to biological systems. Yet, no simulation system provides comprehensive facilities for studying such models conveniently by computer. Such a system is proposed and an implementation exhibited. Careful attention is given to setting forth the guiding considerations in developing the final form of the system for supporting heuristic and interactive exploration of model behavior. Chapter 1 develops the notions of cellular spaces (regular geometry, neighborhood template, transition function) and reviews models used by von Neumann, Codd, Flanigan, Finley and Holland. Chapter 2 analyses these models and formulates the requirements for building a simulation system suitable for a wide range of cellular models. Chapters 3 and 4 describe a total programming system for simulation. A language is designed that provides novel constructs useful for cellular models. A simulation support system provides on-line monitoring of model behavior on a graph CRT and experimenter interaction with the system via keyboard and lightpen. Chapter 5 discusses several applications developed on the system, and evaluates and summarizes the work. Several appendices detail the implementation. Author (TAB)

N70-32628# Naval Postgraduate School, Monterey, Calif.
A UNIVERSAL SYNTAX CHECKER
John Francis Leahy, III (M.S. Thesis) Jun. 1969 66 p refs
(AD-704087) Avail: CFSTI CSCL 5/7

A universal syntax checker was constructed to be utilized with a text editor in a time-sharing environment. This syntax checker is a top-down left-right slow-back parser that will provide, when supplied the syntax of any language in the Backus-normal form, a syntax check for any string written in a language described. The procedure is capable of handling left, right, and self-embedded recursive definitions. Author (TAB)

N70-32630# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIRECT ACCESS STORAGE DEVICE WITH FULL CURRENTS
Yu. S. Yakovlev 24 Mar. 1970 15 p refs Transl. into ENGLISH from Mekhaniz. Avtomatiz. Upravleniya (USSR), no. 6, 1968 p 46–49
(AD-705213; FTD-HT-23-93-70) Avail: CFSTI CSCL 9/2

A description is given of a computer memory unit. It contains magnetic bias lines, selection and write lines which thread through auxiliary (switching) magnetic cores, working (memory) magnetic cores with output windings, coupling windings, auxiliary numeric magnetic cores, with auxiliary numeric selection lines, and output windings, and semiconductor diodes. Samples of the described unit were built having a storage capacity of 256 bits and a word length of 13. TAB

N70-32644# Comptre Corp., Coral Gables, Fla.
SURVEY AND ANALYSIS OF MAJOR COMPUTING OPERATING SYSTEMS (OS SURVEY) Final Report, Jul. 1969 - Jan. 1970
Clinton S. Mc Intosh, Roger H. Evans, and Robert Lastra Jan. 1970 289 p refs
(Contract F19628-69-C-0291)
(AD-704138; ESD-TR-70-65) Avail: CFSTI CSCL 9/2

The major contemporary computer operating systems were surveyed and analyzed for the purpose of defining a functional classification structure applicable and common to the executive/control functions of all operating systems. In addition, performance parameters were developed for each of the common functions and the technical feasibility of various operating system validation techniques were assessed. While it was determined that an automated general purpose validation system is technically feasible, it is impractical at the present time. Author (TAB)

N70-32669*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FORTRAN SUBROUTINE FOR ROTATION OF THREE-DIMENSIONAL LINE FIGURES
Kenneth Paciulan Washington Jul. 1970 15 p
(NASA-TM-X-2036; C-122) Avail: CFSTI CSCL 09B

In projecting a three-dimensional line figure onto a plane, it is sometimes necessary to choose more than one projection of the figure in order to obtain a clear idea of what the projection represents. This can be done by rotating the object and projecting it onto the original plane. The computations involved are explained, and a FORTRAN subroutine to carry out these computations is described in detail. Author

N70-32676# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIRIUS INPUT LANGUAGE FOR AN AUTOMATIC PROGRAMMING SYSTEM
I. R. Akselrod et al 19 Mar. 1970 21 p refs Transl. into ENGLISH from Dokl. Seminar Avtomatiz. Programmirovaniya (USSR), no. 3, 1967 p 44-62
(AD-705214; FTD-HT-23-114-70) Avail: CFSTI CSCL 9/2

The SIRIUS language is intended for solving both numerical and analytical problems. The new language is realized by means of a two-phase translator. The first phase is a translation into an intermediate (Polish-nonparenthatic) language; the second phase is an interpretation from this language. Two modes of program execution are envisaged in the SIRIUS language: automatic programming and man-machine conversation programming. Programs for problem solution include two types of information: initial nonalgorithmic and algorithmic; the first type includes formulas, equations, and relations written in the generally-used linearized notation; the second type includes a sequence of instructions expressed by Russian verbs in the imperative form. The SIRIUS language uses Russian, Latin, and Greek characters, numerials, true-false symbols, operation symbols, operators, and housekeeping words and symbols. TAB

N70-32704# Electric and Musical Industries, Ltd., Hayes (England).
A PATTERN RECOGNITION SYSTEM USING A SEQUENTIAL FEATURE DECISION MECHANISM
P. Murden and M. Symons *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 13 p ref Sponsored in part by Min. of Technol. (See N70-32686 17-16)
Avail: CFSTI

In this paper an adaptive pattern recognition system is described, which has been simulated using a digital computer coupled to an on-line T.V. camera. An edge following technique is used for extracting features from the input patterns, which are converted into 64-level form. A prediction technique is introduced to enable non-contiguous features to be examined. Operation is divided into training and testing modes; in the training mode some of the descriptors derived from the extracted features are stored according to certain algorithms. Statistics relating to these descriptors and the picture class are built up. In the testing mode, each picture is taken from another set, and features are extracted for comparison with the stored descriptors, to enable a sequential decision mechanism to derive the classification. The experimental results quoted represent the initial studies of the system using handwritten and poor quality fixed-font numerics. Author

N70-32705# Olivetti (C.) and C., S.p.A., Turin (Italy). Gruppo Ricerca e Sviluppo.
FILTERING AND OPTIMAL THRESHOLD FINDING PROCEDURES FOR AUTOMATIC PROCESSING OF BIDIMENSIONAL LINEAL PATTERNS
F. Demonte and M. Prennusmi *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 refs (See N70-32686 17-16)
Avail: CFSTI

Known pattern recognition systems using holographic spatial filters are very sensible to object orientation and distortion. Therefore they may be called pattern identification rather than pattern recognition systems. An approach is made to improve pattern recognition capability by modelling the hierarchical information processing of the human visual system, which is effectively described by the theory of homogeneous layers of Professor H. Marko, Munich. This modelling is done by using holographic spatial optimal filters for feature extraction and electronic decision circuits. The system is applied to recognition of handwritten characters. Author

N70-32805# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems.
DESCRIPTION OF THE GENERATION OF DATA DECKS BY ETOG-1 FOR USE IN CREATING MUFT AND GAM LIBRARIES
S. Kellman and D. E. Kusner Jan. 1970 26 p refs
(Contract AT(30-1)-3845)
(WCAP-3845-2; ENDF-133) Avail: CFSTI

Values are listed for input parameters to ETOG-1 used in the generation of the accompanying data decks for creating MUFT-4, MUFT-5, GAM-I and GAM-II libraries. A description of required changes made to the input ENDF/B data files for the materials processed is also given. Author (NSA)

N70-32817# Joint Publications Research Service, Washington, D.C.
USE OF MARKOV CHAINS TO ANALYZE ASYNCHRONOUS METHODS OF COMPUTER MULTIPLICATION
B. M. Kagan et al 6 Jul. 1970 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Tekhn. Kibernetika (USSR), no. 1, 1970 p 125-130
(JPRS-50877) Avail: CFSTI

The application of the theory of Markov chains to calculate the speed of asynchronous multiplication methods is discussed. A calculating technique is shown, and relationships are derived for calculating the probabilities of different combinations of multiplier bit positions. The average number of addition and shift cycles are calculated for different multiplication methods. Author

N70-32905# Information International, Inc., Boston, Mass.
RESEARCH IN COMPUTER-ASSISTED DOCUMENTATION OF COMPUTER PROGRAMS, VOLUME 1 Annual Report, 1 Feb. 1968 - 31 Jan. 1969
Edmund C. Berkeley Apr. 1969 128 p ref
(Contract N00014-68-C-0268)
(AD-702742; Rept-230/69) Copyright. Avail: CFSTI CSCL 9/2

The purpose of the research is to discover and develop powerful methods and principles by means of which a computer program which has little or no documentation can be easily documented by a human programmer with the assistance of a computer. The report: discusses the problem of the documentation of computer programs; presents some estimates of industry loss due to the inaccessibility of inadequately documented computer programs; develops the concept of a simulator-analyzer (SA) computer program which simulates the computer and analyzes an undocumented working binary program; gives a complete computer program for an SA (with some 350 machine language instructions) and demonstrates how this SA works on a number of simple examples. The report also begins to analyze an undocumented dynamic degugging program of some 1700 machine words and applies methods of cryptanalysis to deciphering the symbol table in the debugging program. Author (TAB)

N70-32953# International Atomic Energy Agency, Vienna (Austria).
AN INTERNATIONAL NEUTRON DATA SYSTEM
1969 42 p Conf. held at Brookhaven, N.Y., 10 - 14 Feb. 1969
(STI-DOC-10/100; TR-100) Copyright. Avail: IAEA HC $2.00/MF $0.65

The results of panel deliberations based on papers contributed concerning neutron data compilation are presented. An appraisal is given of the current and future needs for nuclear data compilation, of the role of the world's principal neutron data centers, and of the development of the world's principal neutron data centers. The conclusions and recommendations of the panel are presented. NSA

N70-32959# Oak Ridge National Lab., Tenn.
GRAPHICAL DISPLAY PROGRAMS FOR THE HFIR DIGITAL CONTROL AND DATA ACQUISITION SYSTEM
H. P. Danforth and G. R. Owens 9 Feb. 1970 45 p refs Sponsored by AEC
(ORNL-TM-2838) Avail: CFSTI

Three types of graphical display programs were prepared for the HFIR computer system: playback of process variables with several time-scale options, plotting of data stored in the mass memory by a multichannel high-speed input subsystem, and plotting of frequency-dependent, logarithmic, power spectral density data from neutron fluctuation analysis. The functional and operational descriptions of these programs and the plotting calibration routines are included along with block diagrams and assembly language program listings. Author (NSA)

N70-32972*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATAGRAPH: X4080 PROCESS PROGRAM UPDATING
George L. Fleming May 1970 6 p refs
(NASA-TM-X-63964; X-565-70-243) Avail: CFSTI CSCL 09B

The procedure for creating and updating scrip processor routines is outlined. J.M.C.

N70-32999# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVALUATING THE INSTRUCTION FORMAT OF A CONTROL COMPUTER
V. A. Popov 3 Mar. 1970 9 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 11, 1967 p 49 - 51
(AD-704834; FTD-HT-23-134-7016) Avail: CFSTI CSCL 9/2

Algorithms for aircraft computers are analyzed, from the point of view of the number of addresses required to determine the advisability of using a particular logic structure. The mean number of memory accesses in a given problem is calculated, and a numeric example is given. TAB

N70-33030# Oak Ridge National Lab., Tenn.
DEVELOPMENT OF A MASS MEMORY PROGRAM EDITOR FOR THE HFIR DIGITAL CONTROL AND DATA ACQUISITION SYSTEM
G. R. Owens 9 Feb. 1970 43 p ref Sponsored by AEC
(ORNL-TM-2788) Avail: CFSTI

Developing and debugging new software for the High Flux Isotope Reactor computer had required excessive time to edit source programs. Repetitive tape-punching by a slow paper-tape punch unit during editing was the major hindrance. A new editing scheme was developed to use the high-speed, mass memory drum unit for editing in lieu of the paper-tape punch. The computer software was modified to provide direct compilation and assembly of programs located in the mass memory editing area. This new technique allowed program errors to be eliminated prior to punching a paper tape. Software development was accelerated by using the faster program editing method. Author (NSA)

N70-33031# Oak Ridge National Lab., Tenn.
DEVELOPMENT OF AN AUTOMATIC RESTART SYSTEM FOR THE HFIR DIGITAL CONTROL AND DATA ACQUISITION SYSTEM
G. R. Owens 9 Feb. 1970 27 p refs Sponsored by AEC
(ORNL-TM-2787) Avail: CFSTI

An automatic computer restart system was designed to restore the computer to operation after an electrical power failure or an internal fault interruption. Software was developed to restore the computer operating system to routine use with all real-time parameters updated properly. Hardware was developed to turn the computer on automatically after an electrical power outage and to place the restart programs into execution. The reactor operator is permitted access to computer information and reactor control programs quickly after an interruption of computer operation. Author (NSA)

N70-33099# Aerospace Corp., El Segundo, Calif. Electronics Div.
TIME CORRELATION OF ESTIMATION ERRORS WITH AEROSPACE APPLICATIONS
Joseph L. Le May and Allen R. Stubberud 13 Mar. 1970 34 p refs
(Contract F04701-69-C-0066)
(AD-702171; TR-0066(5306)-13, SAMSO-TR-70-79) Avail: CFSTI CSCL 9/4

In the past decade, many theoretical and application papers have appeared in the general area known as estimation theory. The majority of these have dealt with linear recursive estimation theory and often carry the name Kalman filtering, recursive least squares estimation, etc. More recently, theoretical results for nonlinear recursive filters have appeared. This paper presents the theory of estimation error time correlation properties for linear recursive estimators. Then, real applications where correlation properties are important are examined. Finally, an interesting new notion of matching of interacting measurement devices in a system with random inputs is presented as a new area of practical research in sequential estimation theory. Author (TAB)

N70-33105# Joint Publications Research Service, Washington, D.C.
TOWARD A UNIFORM INFORMATION SYSTEM
V. Glushkov 7 Jul. 1970 13 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 4, Apr. 1970 p 30-36
(JPRS-50888) Avail: CFSTI

Soviet computer technology is reflected in terms of establishing a uniform information system. The discussion is centered around the basis importance of the new methods of multiprogramming being developed and used in today's third generation EVM. The machine language, production technology, and reduction of cost of the EVM are also considered. J.M.C.

N70-33106# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A SMALL DIMENSION MEMORY UNIT
L. V. Sadovskii et al 18 Mar. 1970 13 p refs Transl. into ENGLISH from Mekhaniz. Avtomatiz. Upr. (USSR), no. 3, 1968 p 40-43
(AD-704854; FTD-MT-24-22-70) Avail: CFSTI CSCL 9/2

A toroidal-ferrite-type storage is described which was developed for a miniature control digital computer. External and internal memories are combined in one device; they have a common decoder, read amplifiers, output shapers, etc. Direct access and full-current write and read are used in the internal memory. A transformer-type circuit is used in the external memory. The internal-memory cube comprises four 125 x 80 x 15-mm plates, with 32 15-digit numbers on each plate. A transistorized read amplifier has a sensitivity of 150 mv (noise, 30 mv or less). A transistorized read-current shaper converts 0.4-v signals into 0.7-amp, 2.5- mu sec pulses. The decoder is designed with ferrite cores and operates on the current-distribution principle. The storage is claimed to reliably operate at plus or minus 60 centigrade and at supply-voltage variations with plus or minus 20 percent. TAB

N70-33112*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERTRAN: A TRANSPORT-PERTURBATION PROGRAM
John L. Anderson Washington Jul. 1970 65 p refs
(NASA-TN-D-5906; E-5359) Avail: CFSTI CSCL 09B

PERTRAN is written to be used primarily with the two-dimensional transport program TDSN. The equations of first-order transport perturbation theory are cast into three discrete forms consistent with the P-1, transport-corrected P-0, and diffusion approximations. The FORTRAN IV program calculates the neutron lifetime and effective delayed neutron fraction and the reactivity contributions of various reactions for each of the three approximations. Sample problems compare the three perturbation approximations with two-dimensional transport spatial calculations. Input instructions and listings of the program and a sample problem are provided. Author

N70-33131# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME RESULTS OF EXPERIMENTAL INVESTIGATION OF A DETECTOR OF IMAGE ELEMENT DIRECTIONS
V. P. Romanov et al 26 Mar. 1970 23 p refs Transl. into ENGLISH from Tr. Vses. Konf. po Inform.-Poiskovym Sistemam i Avtomatizirovannoi Obrabotke Nauchn.-Tekhn. i Inform., 3d, Moscow, 1966 (USSR), v. 3, 1967 p 85-96
(AD-705142; FTD-HT-23-82-70) Avail: CFSTI CSCL 9/2

An alternative to the so-called integral method of image recognition, in which the image is considered to be a whole unit, is proposed. The defects of the integral method are explained and it is stated that, because of these defects, the method cannot be used as the basis for designing reading machines for literature using many different type faces. The method here explained is the structural method based on research into the field of structural linguistics. It is assumed, in this basic theory, that sets of primitive symbols (the structural elements), sets of parameters, and sets of constructional operations are specified. The image is considered the result of the application of the rules of derivation and transformation to the original set of structural elements. The analysis of the unknown image consists in extracting and identifying the primitive symbols, estimating their parameters, and establishing the types of constructive operations for composing the form. TAB

N70-33151# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
RUNNING DESCRIPTION OF THE TWO DIMENSIONAL BURNUP PROGRAM ASB. VERSION OF THE PROGRAM BY INTERATOM FOR THE IBM 360/65 [VORLAEUFIGE BESCHREIBUNG DES ZWEIDIMENSIONALEN ABBRANDPROGRAMMS ASB. VERSION DES PROGRAMMS VON INTERATOM FUER DIE IBM 360/65]
L. Mayer, D. Sanitz, E. Stein, and G. Willerding Nov. 1969 28 p In GERMAN; ENGLISH summary
(KFK-1079; EUR-4317-d) Avail: AEC Depository Libraries

The two-dimensional burnup and management program ASB for the CDC 1604 A, was adapted for the IBM 360/65. A description of the code and the input is included. Author (NSA)

N70-33187# RAND Corp., Santa Monica, Calif.
INFORMATION SYSTEM DESIGN IN LARGE SCALE LOGISTIC SYSTEMS
E. P. Durbin Mar. 1970 17 p Presented at the NATO Conf., Luxembourg, 19-22 May 1970
(AD-703561; P-4308) Avail: CFSTI CSCL 5/2

Modern systems analysis is an effort to apply structured rationality to problems of choice. To be of use in information system design in large organizations the analyst must be aware that techniques of analysis require time and data. Neither may be available. New techniques are required which allow rapid modeling of information systems. In addition the analyst must understand that institutional factors cause real design to proceed from simultaneous policy and hardware selection through software to the final system. The analyst must supply advice on policy phasing, equipment phasing, flexibility, and backup. The paper described a situation in which a design process goes backwards from what is suggested. The implications for new analysis techniques may not be so much computational as educational. Author (TAB)

N70-33306# National Inst. for Research in Nuclear Science, Chilton (England). Rutherford High Energy Lab.
THE ROUGH DIGITISINGS MERGE PROGRAM
P. M. Girard Jan. 1970 23 p
(RHEL/R-189) Avail: AEC Depository Libraries

Before a bubble-chamber event can be measured accurately using the HPD, it is necessary to examine the film by eye and record the approximate position of each track by digitizing three points along its length. This is done with the assistance of Rough Digitizing machines, which project an enlarged image of the film onto a white table and allow the operator to record measurements automatically by means of a puck placed in turn at the points to be digitized. The function of the MERGE program, which is run next, is to prepare batches of rough-digitized events for feeding into the HPD control program. It collects together from 360 disk the various fragments of data belonging to particular rolls of film, arranges everything in the correct order, and writes a stream of rough digitizings away to magnetic tape in a form suitable for subsequent processing. Finally it frees the disk space formerly occupied by these events so that it can be used again. Author (NSA)

N70-33309# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SEVERAL EXAMPLES OF PROBLEMS HANDLED AT CEA
C. Caillet Nov. 1969 37 p In FRENCH Presented at the Inform. Day on Hybrid and Analogue Calculation, Saclay, France, 13 Nov. 1969
(CEA-CONF-1451) Avail: AEC Depository Libraries

A very brief survey is given of the types of problems which are habitually resolved on the CEA analog and hybrid computers. The types of problems treated are classified into function-of-time systems, systems independent of time, and the problems of optimization and identification. The simulation studies made on a reactor core and then an entire reactor power plant are described. The study of the functioning of accelerators and plasmas leads to an investigation of the trajectories and energies of an individual particle or of a group of particles and, consequently, to the resolution of differential equation systems or systems with partial derivatives. Two examples are given of the use of computers in chemical and physico-chemical processes – the chlorination of benzene and uranium extraction. Problems of compartments and of identification are computer solved in the areas of biology, medicine, and pharmacodynamics. The use of computers in the study of electronic problems is briefly illustrated. NSA

N70-33347# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF CODING THE STATES OF FINITE AUTOMATA FROM THE POINT OF VIEW OF MINIMIZING EQUIPMENT EXPENDITURES
F. L. Rabinovich et al 10 Mar. 1970 19 p ref Transl. into ENGLISH from the book 'Teoriya Diskretnykh Avtomatov' 1967 p 33 – 40
(AD-704852; FTD-MT-24-08-70) Avail: CFSTI CSCL 9/2

A method is proposed for coding the states of finite automata to minimize the equipment necessary for realization. The problem arises in the synthesis of control automata that must possess means for decoding each state during formation of the output control signals. The method consists in representing the automaton as a composition of the simplest partial automata. TAB

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-32025# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
INVESTIGATION OF USE OF SUPERIMPOSED SURFACE WAVE MODES, PART 4 Final Report, 1 Mar. 1968 – 31 Jan. 1970
Nam S. Wong, Raymond Tang, George H. Okubo, and Shung-Wu Lee 1 Jan. 1970 93 p refs
(Contract F19628-68-C-0185)
(AD-704563; FR-70-14-284; AFCRL-70-0183) Avail: CFSTI CSCL 9/5

A method of achieving a matched aperture in phased arrays over a wide range of scan angle has been investigated. This method uses two or more propagating modes in each array element such that the reflections of these modes from the array aperture produce a cancellation effect at the element driving terminal. An experimental 256 element planar array was constructed to demonstrate this technique. Each radiating element consists of an open-ended waveguide driven by an end-on coaxial transition. Modal amplitude control of higher order modes is accomplished by means of either a perforated dielectric slab or an inductive iris at the aperture. Author (TAB)

N70-32055*# AiResearch Mfg. Co., Los Angeles, Calif.
APPROACH TO DEFINE RELATIVE WEIGHTED FACTORS WHICH DETERMINE SYSTEM EFFECTIVENESS
In its Invest. and Develop. of New Concepts for Improvement of Aircraft Elec. Power Systems 23 Jan. 1970 9 p (See N70-32051 17-03)
Avail: CFSTI CSCL 01B

Relative weighted factors that determine system effectiveness are examined as well as aircraft electric equipment weight criteria. Author

N70-32099# Air Force Cambridge Research Labs., Bedford, Mass.
A NEW IDEA FOR REALIZING POSITIVE REAL IMMITTANCE FUNCTIONS OF EVEN RANK
Kurt H. Haase Jan. 1970 31 p refs
(AD-704558; AFCRL-PSRD-403; AFCRL-70-0013) Avail: CFSTI CSCL 9/5

A novel electrical circuit designed according to the theory postulated in this paper delivers a prescribed immittance response. A driving-point function F bar (s) is realized by a single-T circuit and/or a single-pi circuit, implying a negative resistor but otherwise positive elements; a positive real immittance function F(s) is realized by the same circuits augmented by an immittance k/(s) of low rank at the input. The circuit has high reliability and a rugged stability in the face of environmental changes. In addition, its low weight and small size fulfill requirements for military applications. Author (TAB)

N70-32132# Naval Postgraduate School, Monterey, Calif.
COMPUTER-AIDED DESIGN OF PASSIVE FILTERS IN THE FREQUENCY DOMAIN USING GRADIENT-PROJECTION MINIMIZATION TECHNIQUES
Charles Alden Henry (M.S. Thesis) Dec. 1969 105 p refs
(AD-705080) Avail: CFSTI CSCL 9/5

An algorithm for the computer-aided design of passive electrical filters using minimization techniques is presented. The configuration, or topology of the filter and its desired frequency response are specified. A measure of the deviation between the desired and the actual frequency response is minimized using the gradient projection search method. Examples are presented which demonstrate the performance of the minimization procedure. Author (TAB)

N70-32221# Southwest Research Inst., San Antonio, Tex.
LF TO VHF SHIPBOARD DIRECTION FINDING RESEARCH Final Report, 1 Jan. 1969 – 2 Mar. 1970
T. C. Green, W. M. Sherrill, and R. Lorenz 2 Mar. 1970 55 p refs
(Contract N00024-69-C-1205)
(AD-704151) Avail: CFSTI CSCL 17/3

The DF performance of the ferrite core crossed spaced loop antenna at the SwRI full-scale superstructure site showed calibration curves equivalent to the air core spaced loop previously tested. This included 2:1 reradiation error reduction compared to a simple loop and the elimination of multivalued and no bearing calibration curves. A five-element phase measuring interferometer was operated on the ship superstructure site using crossed simple loop antenna elements with sensitivity in excess of 20 microvolts/m at 2 MHz with commensurate improvement above 2 MHz. Baseline lengths employed were 270 x 105 ft. Azimuth and elevation calculations on skywave and ground wave targets were performed in real time using an on-line digital computer. DF errors averaged less than plus or minus 5 deg. over the bearing circle with the

exception of narrow angular sections in the loop null regions. These can be eliminated by omnidirectional loop antennas. The SwRI direction finding calibrator was used with an on-line computer to provide automatic bearing corrector capability with a polar CRT direction finder display. Author (TAB)

N70-32286*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE SECOND WORKSHOP ON VOLTAGE BREAKDOWN IN ELECTRONIC EQUIPMENT AT LOW AIR PRESSURE
E. R. Bunker, Jr., ed. 30 Jun. 1970 218 p refs Held at Pasadena, Calif., 5-7 Mar. 1969
(Contract NAS7-100)
(NASA-CR-110627; JPL-TM-33-447) Avail: CFSTI CSCL 09E

Problems are considered in preventing voltage breakdown affecting electronic equipment operating at high altitudes or other low air pressure environments. For individual titles see N70-32287 through N70-32309.

N70-32287*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF VOLTAGE BREAKDOWN IN SPACECRAFT SYSTEMS FROM TEST AND FLIGHT EXPERIENCE
J. E. Stern and K. R. Mercy *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 3-8 ref (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

A summary of voltage breakdowns in test and flight systems for each year from 1961 through 1967 is presented. Classification of the breakdown occurrences according to the phenomena of corona, arc-over, and multipactor is shown. The surveys show that the frequency of voltage breakdowns has not diminished in the past several years, design is the area most responsible for breakdown problems, most breakdowns are dc gas discharges, although multipactor discharges are becoming more numerous, and major factors affecting gas discharges are outgassing, entrapped gases, insulation, geometry, and circuit arrangements. Methods are proposed to overcome the general design problems. R.B.

N70-32288*# Martin Marietta Corp., Denver, Colo. Electronics Research and Development Dept.
SOME OBSERVATIONS OF CORONA BREAKDOWN ON VARIOUS ANTENNA TYPES IN SIMULATED PLANETARY ATMOSPHERES
C. H. Brockmeyer *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 9-18 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09B

Tests were conducted on antennas immersed in gases of nitrogen, carbon dioxide, argon, and air to determine the breakdown behavior of these gases. The antennas were tested in a high altitude chamber at various pressures and power inputs. The tests indicate that the composition of the gas, as simulated for earth atmosphere and other planets, has little effect on the breakdown level of an antenna, but the pressures have a major effect on breakdown. R.B.

N70-32289*# Stanford Research Inst., Menlo Park, Calif.
VHF BREAKDOWN ON A NIKE-CAJUN ROCKET
J. B. Chown, J. E. Nanevicz, and E. F. Vance *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 20 Jun. 1970 p 19-28 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

Laboratory tests were conducted on a VHF quadraloop antenna identical to one used in a Nike-Cajun rocket flight. Discrepancies appeared between laboratory tests and flight test data because flight conditions had not been properly simulated. The tests show that multipacting breakdown occurs due to outgassing and that there is a reduction in local gas density and a change in breakdown thresholds due to shock effects. R.B.

N70-32290*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF PACKAGING TECHNIQUES FOR AN AMPLITRON AND POWER SUPPLY
P. Felsenthal, D. Grieco (Raytheon Co., Sudbury, Mass.), and J. Fridman (Raytheon Co., Sudbury, Mass.) *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 29-39 Prepared in cooperation with Raytheon Co., Sudbury, Mass. (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

Potting techniques of a high-voltage module and testing of an amplitron tube and RF problems in a microwave circulator are examined. The equipment consists of a dc to dc converter and redundant amplitron system, the system being symmetrical along the mounting flange. The equipment function is described and failures that occurred with the old construction are discussed. R.B.

N70-32292*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
LOW-VOLTAGE BREAKDOWN IN ELECTRONIC EQUIPMENT WHEN EXPOSED TO A PARTIAL-PRESSURE NITROGEN ENVIRONMENT CONTAINING WATER VAPOR
R. F. Sharp, E. L. Meyer, and D. E. Collins JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 49-57 (See N70-32286 27-09)
Avail: CFSTI CSCL 09E

The tests were conducted to evaluate the voltage breakdown susceptibility of the electronic equipment, to determine the effects of low pressure on voltage breakdown, and to determine the effects of humidity on voltage breakdown in a low-pressure environment. The results indicate that the addition of water vapor raises the voltage breakdown threshold, and that in typical electronic equipment extreme care is required when applying the Paschen curve to predict critical pressure. R.B.

N70-32293*# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
THE BENDIX OAO STAR TRACKER HIGH-VOLTAGE SYSTEM AND ITS DESIGN CONSIDERATIONS
W. Mitchell *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 59-72 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

After failure of the OAO star tracker high-voltage system, a reevaluation of the vehicle-star tracker configuration indicated that a non-vacuum environment existed in the vicinity of the star tracker for a considerable period of time. Modifications were necessary to permit operation at all pressures, which required elimination of the air dielectric in several regions of the instrument. Solutions are proposed to prevent failure of the high-voltage system. R.B.

N70-32294*# Sylvania Electric Products, Inc., Needham, Mass.
A VENTED HIGH-VOLTAGE SYSTEM FOR SATELLITE APPLICATIONS
D. Laffert *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 73-76 (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

Modifications were made in a vented high-voltage system, including current limiting and arc detection in the power supply, protection of adjacent circuits through shielding, protection of

adjacent circuits through special electrical design, component selection, and ruggedized vented mounting techniques. Vacuum and thermal vacuum tests indicate that the modified system operates properly at either ambient pressure in a hard vacuum. R.B.

N70-32295*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
OPEN CONSTRUCTION MAGNETIC COMPONENTS FOR THE SERT 2 POWER CONDITIONER
D. S. Yorksie and J. Lagadinos (Raytheon Co., Waltham, Mass.) *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 77–90 Prepared in cooperation with Raytheon Co., Waltham, Mass. (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

Open construction magentic components for the SERT 2 power conditioner were designed to take advantage of the inherent dielectric strength of the space vacuum, to provide minimum weight, and to avoid problems caused by outgassing of encapsulating compounds. The development program for these components is described, with emphasis on high-voltage power transformers. R.B.

N70-32296*# Transformer Electronics Co., Boulder, Colo.
DESIGN CONSIDERATIONS FOR CORONA-FREE HIGH-VOLTAGE TRANSFORMERS
Harold C. Byers *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 91–98 (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

Design considerations are considered for eliminating corona in high-voltage toroidal transformers to be used at low air pressures. Recommendations for optimum design of such transformers include selecting a core of sufficient size and proper construction, selecting wire of sufficient size for reliability, selecting an interlayer insulating material compatible with the impregnating material to be used, and choosing impregnating and encapsulating materials which are compatible with each other and with core coating, wire insulation, and the interlayer insulating material. R.B.

N70-32297*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-VOLTAGE PACKAGING INVESTIGATIONS IN THE ADVANCED TECHNOLOGY GROUP
E. R. Bunker, Jr. *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 99–108 (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

High-voltage packaging studies were performed to establish parameters and techniques in the critical air pressure and high-vacuum regions, to improve instrumentation and establish test procedures for the existence of corona in equipment and components, and to prepare specifications on the design and packaging of high-voltage circuitry. Tests were conducted on transformers to detect voids or defects in winding-to-winding insulation and voids in the insulation between turns of the same winding. R.B.

N70-32298*# Boeing Co., Seattle, Wash. Aerospace Group.
CORONA EVALUATION OF SPACECRAFT WIRES AND CONNECTORS
W. G. Dunbar *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 109–116 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09A

The corona-onset (COV) and corona-extinction (CEV) voltage of spacecraft electrical and electronic wiring, components, and systems were measured. The tests indicate that the minimum COV of a twisted pair is always greater than that of a spaced pair having the same wire size and insulation thickness, the difference depending on the dielectric constant of the insulation, the thickness of insulation, wire size, and voltage stress. Tests of different types of wire also show that flat conductor cable has a higher COV at minimum pressure spacings and round wire configuration. R.B.

N70-32368# Defense Documentation Center, Alexandria, Va.
PACKAGED CIRCUITS, VOLUME 1 A DDC Bibliography, Mar. 1969 – Feb. 1969
Apr. 1970 160 p refs
(AD-704925; DDC-TAS-70-39-1) Avail: CFSTI CSCL 9/5

Selective references include: compatible techniques for integrated circuitry; results of studies to determine optimum packaging techniques for the electronic equipment and the shock levels that the different packages and certain electronic components could withstand; a system for computer-aided selection and assignment of electronic modules; an electronic packaging program was initiated to develop and evaluate integrated circuit packaging techniques applicable to unmanned scientific spacecraft data system; and all aspects of microcircuit packaging are studied and each of the three basic approaches to the packaging of microcircuits are investigated and evaluated, namely, type of containers, glass and metal flat packages, and encapsulated type packages. Author (TAB)

N70-32432# Westinghouse Electric Corp., Baltimore, Md. Aerospace and Electronic Systems Div.
THE 3200 ANGSTROM PHOSPHOR Quarterly Report, 1 Oct. –31 Dec. 1969
Jon W. Ogland, Edward C. Malarkey, and Michael R. Natale Fort Monmouth, N.J. ECOM Apr. 1970 44 p
(Contract DAAB07-68-C-0392)
(AD-704711; ECOM-0392-6; QR-6) Avail: CFSTI CSCL 11/7

Further improvements were made in techniques for preparing phosphor screens for efficiency tests, and a demountable vacuum station which will allow multi-sample efficiency measurements has been put into operation. New samples of Zn_2SiO_4:TiO_2 were supplied to the 3800 A tube manufacturer, with some improvements made in reducing the particle sizes. An efficiency approaching 6% was measured on a screen settled by the same procedure to be used for the 3800 A tubes. Samples of beta-$CaSiO_3$:Pb continued to show increasing efficiency with loading, and a value of 1.7% was observed at high loading. For beta-$BaSi_2O_5$, efficiencies of 4% at low input and 2% at high input were measured. Efficiencies at low inputs of 2.5% to 3.5% were measured for $Ba_{1.3}Zn_{0.7}Si_4O_{10}$:Pb, but screen darkening under the beam prevented meaningful measurements at higher inputs. Significant improvements have been made in the output from samples of the $(Sr,Ca,Zn)_3Si_2O_7$:Pb series. Satisfactory preliminary designs for tubes with the UV fiber optic face-plates which have unusual expansion coefficients have been made. Author (TAB)

N70-32487# ARO, Inc., Arnold Air Force Station, Tenn.
INTENSITY MODULATED LIGHT SOURCE USABLE TO 100 MHz Final Report, Dec. –Jul. 1969
F. L. Crosswy and H. T. Kalb AEDC Mar. 1970 24 p refs
(Contract F40600-69-C-0001)
(AD-702079; AEDC-TR-70-34) Avail: CFSTI CSCL 20/6

A gallium arsenide light emitting diode, with emission wavelength range from 6000 to 7000 A, and a driver amplifier assembly are used to simulate the signal produced by a Doppler shift laser velocimeter (LV). The light source device is then used to check the entire electronics portion of the LV without assembling the LV optical components. The frequency domain optical response of the device was found to be flat from 0 to about 15 MHz. However, usable optical output was obtained at 100 MHz. Author (TAB)

N70-32506# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SINGLE PULSE DELAY LINE
L. K. Samoilov 8 Jan. 1970 20 p refs Transl. into ENGLISH from Radiotekhn. (Moscow), v. 23, no. 6, 1968 p 51–62
(AD-701983; FTD-HT-23-333-69) Avail: CFSTI CSCL 9/5

The transistorized single-pulse delay line is described. The authors intent was to design a general-purpose, stable delay line which could operate at cycling frequencies well above the maximum for ferrite delay lines. A detailed description is given of the circuit operation and design calculations for each stage are presented. Theoretically, the line can operate at up to 8 MHz; actual tests at 3 MHz have been made. TAB

N70-32553# Naval Postgraduate School, Monterey, Calif.
WAVEGUIDE TESTING WITH NANOSECOND RF VOLTAGE PULSES
William Carl Schmidt (M.S. Thesis) Jun. 1969 47 p refs
(AD-704526) Avail: CFSTI CSCL 9/1

The testing of waveguide systems was demonstrated using nanosecond r-f pulses. Pulse generation was effected by d-c coupled pulse grid modulation of a traveling-wave tube. This d-c modulation pulse was produced through the use of a fast thyratron circuit. Resultant r-f voltage pulses were used to drive a waveguide system and reflections from waveguide obstructions were viewed on a high-speed sampling oscilloscope. The location and reflection coefficients of obstructions were then obtained from measurements taken on the oscilloscope face. Author (TAB)

N70-32616# Naval Postgraduate School, Monterey, Calif.
COMMUTATED NETWORK FILTER
Tor Roenholt Nilsen (M.S. Thesis) Dec. 1969 57 p refs
(AD-702064) Avail: CFSTI CSCL 9/5

The report presents the results obtained in computer simulations of the commutated network filter. The commutated network filter is also used as a bandpass filter in servosystems. A linear approximation to the transfer function is found to be usable for design purposes. Author (TAB)

N70-32638*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METALLIZATION SYSTEMS FOR INTEGRATED CIRCUITS
Rosemary P. Beatty Washington Jul. 1970 25 p
(NASA-TN-D-5866; C-112) Avail: CFSTI CSCL 09E

Metallization-related failure mechanisms have been shown to be a major cause of integrated circuit failures under accelerated stress conditions. This survey will concentrate on inherent limitations in material combinations and methods of detecting these to provide guide lines for characterization and selection of metallization systems for integrated circuits. Author

N70-32648# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THERMALLY DEPENDENT VARIATIONS IN FREQUENCY DURING THE OSCILLATION PULSE OF AVALANCHE TRANSIT TIME DIODES [THERMICH BEDINGTE FREQUENZVARIATION WAEHREND DES SCHWINGUNGSIMPULSES BEI LAWINEN-LAUFZEIT-DIODEN]
C. Wunsche Lexington, Mass. MIT, Lincoln Lab. Feb. 1970 11 p refs Transl. into ENGLISH from Nachrtech. Fachber. (Brunswick), v. 35, 1968 p 535–539 Presented at the 7th Intern. Conf. on Microwave and Opt. Generation and Amplification (MOGA), Hamburg, 16-20 Sep. 1968 Prepared for MIT, Lincoln Lab.
(AZT-70-194-GELL) Avail: CFSTI

The variation of frequency during the oscillation pulse of avalanche transit time diodes appearing at constant current and constant amplitude of oscillation, together with the thermally dependent rise of diode voltage, is related to an equivalent variation of the large signal reactance of the diode. This can be shown to be in agreement with the temperature-dependence of the derivative of the ionization rate to the electric field, using small signal models. Author

N70-32698# Laboratoires d'Electronique et de Physique Appliquee, Paris (France).
A NEW STORAGE DISPLAY PANEL UTILIZING COLOR CENTERS
Jean J. Robillard *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 15 p refs (See N70-32686 17-16)
Avail: CFSTI

A new type of passive display based on the selective generation and erasing of color centers in alkali halide layers is described. The display can be activated either optically (laser, light beam, optical image) or electrically (crossbar). The erasing is made electrically. Very high resolution can be reached with optical activation. Author

N70-32699# Royal Radar Establishment, Malvern (England).
COLOUR CENTRES IN SODALITES FOR STORAGE DISPLAYS
P. A. Forrester, D. J. Marshall, S. D. Mc Laughlan, and M. J. Taylor *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 10 p refs (See N70-32686 17-16)
Avail: CFSTI

Examined are inorganic materials, particularly those which were known to be photochromic, and those which were known to colour readily by X-rays or other ionizing radiations. Many materials colored under electron beam excitation to varying degrees, but the greatest writing speeds were obtained from members of the sodalite group of minerals. The purpose of this paper is to report the results of some of our measurements on hydrothermally synthesized members of the sodalite family. Author

N70-32700# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
THE DESIGN OF REAL TIME DISPLAYS FOR AIRBORNE IMAGE FORMING SENSORS
G. K. Slocum *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 13 p (See N70-32686 17-16)
Avail: CFSTI

A real time airborne display can alternately be used for several different types of image forming sensors. Low frame rate sensors such as air-to-air radar, forward sector ground map radar, side looking radar, air-to-air IR, and line scan IR all require some form of storage in the display system to present a full flicker-free image to a viewing operator. High frame rate sensors such as forward looking raster scan IR and TV do not require image storage. The best image quality for both high and low frame rate sensors is provided by a scan converter and cathode-ray tube (CRT) display. Using the scan-converter, low frame rate sensor imagery is electrically stored and converted to a high frame rate TV-type image which is presented on the CRT. High frame rate sensor imagery is presented directly on the CRT. A direct view storage tube can provide a high brightness display of low frame rate sensor imagery but the quality of high frame rate sensor imagery is generally poorer. A long (or dual) persistence CRT can be used in low ambient light for both high and low frame rate imagery, but low image brightness and smearing of images that move seriously compromise image quality. Author

N70-32701# Radiotechnique Compelec, Caen (France).
XY GaAs LAMP MOSAIC FACING XY Si PHOTOTHYRISTOR MOSAIC

J. Fertin, J. C. Dubois, J. Lebailly, and J. Thillays *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 13 p refs (See N70-32586 17-16)
Avail: CFSTI

This paper deals with structural and performance properties of a XY solid state panel, usable for interconnection applications. The panel is composed of a 8 x 8 gallium arsenide electroluminescent diode array, facing a 8 x 8 silicon photothyristor array. The electroluminescent arrays are made by localized solution regrowth and planar diffusion processes on a semi-insulating substrate. The doping conditions are such that the emitted photons do not penetrate in the insulating substrate. Under these circumstances, the wavelength is 8750 A and the output light power 4 microwatts/A. For the receiver mosaics, two structures have been tested: (1) a lateral; and (2) a vertical structure. The lateral structure has proved to be integratable and leads to the following characteristics: sensitivity 0.7 microwatts, corresponding to a gate current of 0.2 microamperes; response time: 1.5 microseconds. Author

N70-32781# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MULTIFUNCTIONAL FAST-ACTING FERRITE DIODE ELEMENTS
G. I. Dmitrakova 27 Feb. 1970 10 p refs Transl. into ENGLISH from Tr. Soveshch., Chast 2; Vsesoyuznoye Soveshch. po Magnitnym Elementam Avtomatiki i Vychislitel'noy Tekhn., 11th, Tallin (Moscow), 1968 p 161–163
(AD-704759; FTD-HT-23-111-70) Avail: CFSTI CSCL 9/2

Several schemes of multifunctional logic elements are examined; they are based on the well-known principle of switching the advancing currents by turning off the diodes by output voltages of ferrite cores. With any combination of binary information, three cores switch their magnetism. Any logic operation is performed in one cycle. The results of several logic functions can be taken off simultaneously. The same switching principle was used for designing a three-point universal logic element (block diagram given). Three cores out of six switch when any information arrives. Such an element is essentially a single-digit summer with three inputs; the element can also be regarded as an 8-position decoder designed with three pairs of cores. A simple-circuit multifunctional element is able to perform all logic functions except for the EQUIVALENCE OPERATION AND ITS NEGATION. The above elements were tried with 0.25 VT 2 times 1.4 times 1 mm cores and tested at 500 kHz with advancing currents of about 0.5 amp. Author (TAB)

N70-32812# North Carolina State Univ., Raleigh. Center for Acoustical Studies.
A MATHEMATICAL MODEL FOR THE CLASS 5 FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER
Ralph A. Nelson, Jr. and Larry H. Royster Jan. 1970 91 p refs
(Nonr-48611)
(AD-702049; CAS-57; TR-12) Avail: CFSTI CSCL 9/1

The purpose of this investigation is to develop a mathematical model for the Class V flextensional underwater acoustic transducer. The transducer is approximated through the consideration of three distinct problems. The problem of a thin piezoelectric disk with an arbitrary impedance on its edge is solved in terms of Bessel functions. The shell vibration problem is solved using a finite difference model to approximate the shell. The acoustic radiation problem is solved by obtaining the source density distribution for a system of quadrilaterals representing the transducer. With the source density of each quadrilateral, the near and far field pressures and velocities can be found. Utilizing these three components, a model is then constructed for the transducer. A comparison of the results from the mathematical model with those obtained from experiments is made in order to validate the model. Author (TAB)

N70-32863*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF AFTEREFFECT PHENOMENA IN VIDICON TUBES [ZUM PROBLEM DER NACHWIRKUNGSERSCHEINUNGEN IM VIDICON]
Walter Heimann Washington NASA Jul. 1970 11 p refs Transl. into ENGLISH from Arch. der Elek. Übertragung, v. 10, no. 2, 1956 p 73–76
(Contract NASw-2037)
(NASA-TT-F-13,069) Avail: CFSTI CSCL 09A

Following the description of the general operational properties and characteristics of vidicon tubes, the results of investigations into the causes underlying the disturbing time-lag and aftereffect phenomena are communicated. As indicated in the earlier general discussion, these disturbing effects are determined by properties of the semiconductor layer and the mechanism of signal generation. Systematical experiments were conducted with tubes of different picture element capacitance (different layer thickness) and tubes of higher diameter (larger photoelectric and storage layers) operated with raster surfaces of different sizes. Additionally an attempt was made to measure the layer capacitance in different ways. The discussion of the results gives evidence of the importance of the layer capacitance for the aftereffect phenomena. By suitable dimensioning of the layers more favorable compromise values thus can be attained with respect to tube time-lag. Author

N70-32869# Joint Publications Research Service, Washington, D.C.
ROTARY INDUCTOSYN TESTS
D. A. Bychatin et al 19 Jun. 1970 11 p Transl. into ENGLISH from the booklet 'Povorotnyy Induktosin' Leningrad, Energiya Press, 1969 p 85–97
(JPRS-50776) Avail: CFSTI

A method for testing multiterminal inductance angular displacement sensors which operate on audio frequency alternating current is presented. The measurement of phase and amplitude errors is analyzed, and a unit that permits automation of the measurements in the testing process is described. F.O.S.

N70-32899*# Chrysler Corp., New Orleans, La. Space Div.
STUDY TO DEVELOP AN IMPROVED UNIVERSAL POSITION SWITCH FOR LAUNCH COMPLEX 39 SERVICE ABM APPLICATION Final Technical Report
C. E. Thomas 1 Dec. 1969 67 p
(Contract NAS10-6063)
(NASA-CR-110730; TR-1058-(TR-EE-69-39)) Avail: CFSTI CSCL 09A

This study includes a determination of desired universal position switch characteristics, a survey of the state of the art, selection of test candidates, design verification testing and evaluation, and refurbishment of test samples to incorporate certain design changes found to be desirable during testing. The study revealed a lack of off-the-shelf switches which have characteristics approaching those determined to be desirable for this application. Three switch designs were selected for design verification testing. Two switches were new designs; the third switch involved minor design changes and repackaging. Author

N70-32904*# Baldwin Electronics, Inc., Little Rock, Ark.
LOW-POWER ENCODER SYSTEM USING ELECTRON BEAM DERIVED FROM A COLD SOURCE Final Report
Ralph Hafle 27 Apr. 1970 42 p
(Contract NAS8-24273)
(NASA-CR-102781) Avail: CFSTI CSCL 09E

A breadboarded encoder system utilizing a cold source of electrons and designed to adhere to the goal of minimum power consumption was developed. However, sustained operation of a cold source in the developed system was not achieved. Emission

levels of the cold electron sources were increased approximately one order of magnitude during the course of the development effort. Operational lifetime tests of the improved electron sources were conducted and source lifetimes in excess of 500 hours were achieved. However, placement of identical sources in the confines of the electron optics assembly resulted in early failure. Author

N70-32907*# Texas Instruments, Inc., Houston.
THE DEVELOPMENT OF QUALITY STANDARDS FOR BIPOLAR LSI, VOLUME 2 Final Report, 15 Apr. 1968–15 Apr. 1969
Nov. 1969 17 p refs
(Contract NAS8-21319)
(NASA-CR-102789) Avail: CFSTI CSCL 09E

Outlines and methods for establishing electrical tests, process controls, and process screening tests that should be applied to insure meeting of quality, reliability and maintainability requirements of LSI devices are presented. Author

N70-32919*# Boeing Co., Seattle, Wash.
RADIATION INDUCED NONLINEAR DEGRADATION OF TRANSISTOR GAIN
Washington NASA Jul. 1970 228 p refs
(Contract NAS5-10443)
(NASA-CR-1566; D2-125680-3) Avail: CFSTI CSCL 09E

Correlation and equivalence factors of radiation induced nonlinear degradation of transistor current gain were established. A one MeV electron exposure test of transistors was used to empirically formulate aspects of the dependence of nonlinear damage on radiation and to determine the influence of continuous electrical operation during exposure on the magnitude of device damage. Cobalt 60 gamma radiation exposure of devices was extended to high doses to provide improved data on gamma radiation displacement equivalences. Separate electron tests and 15 MeV proton tests were conducted to determine the best test plan approach for combined synergistic tests. Proton testing at 15 MeV was extended to high fluences to further study the importance of ionization effects and to improve displacement equivalence values obtained previously. A statistical study of passive transistors revealed that effects on devices within a batch tend to behave similarly, while devices from separate batches are likely to behave dissimilarly if the batch numbers are very different. Author

N70-32930*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VIBRATION TOLERANCE OF A MERCURY-COLUMN COULOMETER
Richard R. Secunde and Arthur G. Birchenough Jun. 1970 11 p refs
(NASA-TM-X-52854) Avail: CFSTI CSCL 14B

A mercury-column coulometer was subjected to and successfully survived vibration tests. The impedance of the coulometer was found to be lower during vibration than without vibration. Its integrating ability was not affected by these vibration tests. Author

N70-33044*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHASE INTERPOLATION CIRCUITS FOR SCANNING PHASED ARRAYS
R. J. Mailloux, P. R. Caron, F. J. La Russa, and C. L. Dunne Washington Jul. 1970 13 p refs
(NASA-TN-D-5865; C-131) Avail: CFSTI CSCL 09E

The classes of circuits described can be used with a phased array antenna in order to allow a given array feed system to provide phase control for a phased array with many more elements. Alternatively, certain variations of these circuits can be used alone to provide phase control for small arrays while using only a single phase shifter for each direction of scan. Author

N70-33072# Sandia Corp., Albuquerque, N. Mex.
TC450 INERTIAL SWITCH MANUFACTURING PROCESS DEVELOPMENT REPORT
Jun. 1969 101 p Sponsored by AEC
(SC-M-69-219) Avail: CFSTI

The TC450 inertial switch is one of the first in a series of miniature inertial switches which utilize the rolamite principle to achieve positive switch actuation above predetermined acceleration and acceleration-time levels. Although the TC450 is a simple device requiring few, and relatively uncomplicated piece-parts, the manufacturing and testing processes involved in its production require several unique items of equipment, environmental-control procedures, and handling techniques. The step by step prototype manufacturing and testing procedure for the TC450 is presented, from piece-part preparation to functional and environmental testing. In addition to its use as a laboratory procedures manual, this report is intended to serve as a record of the processes developed for the production of TC450's and as a guide for designers and process engineers in the design and fabrication of future rolamite devices. Author

N70-33094# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
DATA: AN ELECTRONIC DATA PICK UP SYSTEM [DATA, EIN ELEKTRONISCHES MESSWERT-ERFASSUNGSSYSTEM]
H. Brueckmann Dec. 1968 19 p refs In GERMAN; ENGLISH summary
(KFK-912) Avail: AEC Depository Libraries

A new versatile multiparameter data acquisition system designed for nuclear reaction studies is discussed. The system is in use for the investigation of three body reactions where at least two particles have to be detected in coincidence. Four analog signals which may contain information on energy loss, time of flight, or dE/dx are accepted by the system. The information is digitalized and transferred to a CDC computer. The system produces all the logical signals necessary for the common operation of the external electronic equipment. For monitoring, a separate dataway is provided. The use of the system is demonstrated by an experiment where the reaction d + d yields d + p + n was studied. The applicability of the system is not restricted to this example. The high degree of flexibility permits its use for many different problems in nuclear physics. Author (NSA)

N70-33182* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPARATUS FOR COUPLING A PLURALITY OF UNGROUNDED CIRCUITS TO A GROUNDED CIRCUIT PATENT
John Dimeff (inventor (to NASA)) Issued 16 Oct. 1962 (filed 2 Jul. 1959) 4 p Cl. 340-147
(NASA-Case-XAC-00086; US-Patent-3,059,220; US-Patent-Appl-SN-824755) Avail: US Patent Office CSCL 09E

A circuit switching arrangement for use with floating signal transmission channels is described. Signal detection is accomplished by an electromechanical chopper for alternatively charging an ungrounded energy storage means from the floating signal generating device and then discharging the ungrounded energy storage means into a grounded energy storage means. By this arrangement the floating signal generating device is effectively isolated and an electrical signal relative to ground is provided at the output of the channel. P.N.F.

N70-33261*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
A 50-60 GHz LATCHING PHASE SHIFTER Final Report
28 May 1970 44 p
(Contract NAS12-2159)
(NASA-CR-109770) Avail: CFSTI CSCL 09A

A four bit, 360 deg, digital latching ferrite phase shifter was designed and built with the following properties in the frequency bands 50-52 GHz and 58-60 GHz: VSWR as low as possible and insertion loss less than 1 dB. These objectives were to be met by trying alternative approaches, which were: (1) fabricating the active ferrite portion of the device from toroidal segments and placing the assembled toroidal stack in a machined waveguide housing, and (2) electroforming a waveguide structure about either a conventionally machined ferrite toroid stack or a twin slab microwave ferrite structure with the magnetic path completed external to the waveguide. It was concluded that it is possible to fabricate a 50 to 60 GHz digital latching phase shifter, making the waveguide housing, by using conventional machining techniques, but the best approach for fabricating millimeter wave phase shifters would involve electroforming the housing about either a conventional toroid, or preferably a twin ferrite slab. Author

N70-33312* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH INTENSITY HEAT AND LIGHT UNIT Patent
Eldon E. Kordes, Donald H. Trussell, Deene J. Weidman, and George E. Griffith, inventors (to NASA) Issued 17 Oct. 1961 (filed 4 Apr. 1960) 6 p Cl. 219-34
(NASA-Case-XLA-00141; US-Patent-3,005,081; US-Patent-Appl-SN-19971) Avail: US Patent Office CSCL 13A

A high intensity heat and light radiating unit is described which has the lamp elements protectively positioned to withstand severe environmental stress. The unit is designed for use during study and observation of the behavior of structural materials and components subjected to a predetermined intensity of external heating while under the influence of fatigue, high intensity noise, large pressure changes, and high velocity air flow. The unit has quartz-tube lamp elements sunk in grooves formed in the surface of a reflector plate, the grooves acting as reflector surfaces and protection for the lamp elements. R.B.

N70-33378# Joint Publications Research Service, Washington, D.C.
SEMICONDUCTOR ELECTRONICS YESTERDAY, TODAY AND TOMORROW
Ya. A. Fedotov 23 Jun. 1970 19 p refs Transl. into ENGLISH from Radiotekhn. (Moscow), no. 4, 1970 p 10-19
(JPRS-50803) Avail: CFSTI

An overview is presented on the development of technology in the field of semiconductor electronics. A state-of-the-art discussion encompasses the time period from that characterized by the simple transistor up to the present era of integral electronics. Particular emphasis is placed on the invention of planar technology and its revolutionizing impact on semiconductor electronics. Future trends, foreseeable developments, and long range goals in the field are also discussed. D.L.G.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-32070# Stanford Univ., Calif. Information Systems Lab.
PAPERS ON INTEGRATED CIRCUIT SYNTHESIS, 3
Robert W. Newcomb and Manjula B. Waldron, comps. Dec. 1969 103 p refs
(Contract Nonr-225(83))
(AD-704177; TR-6560-19; SU-SEL-69-041) Avail: CFSTI CSCL 9/5

The report constitutes the third, and probably final, collection of term papers presented by graduate students at Stanford University for the Electrical Engineering course EE 367, Active Integrated Network Synthesis, these for the Spring Quarter 1969. Author (TAB)

N70-32300*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE dc VOLTAGE BREAKDOWN PROCESSES AND EXTERNAL DETECTION TECHNIQUES
R. E. Heuser *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 123-130 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09C

It is shown that in space flight breakdown voltage is a function of the distance between electrodes, as well as a function of the product of electrode spacing and pressure. For uniform fields the breakdown is described by Paschen's law. At atmospheric pressure breakdown can be prevented by increasing the electrode spacing, but breakdown occurs at a different pressure in a spacecraft, although the pressure-electrode spacing product is the same. Townsend's ionization coefficient and the similarity principle are used to show that the breakdown voltage is a function of pressure times electrode spacing. Author

N70-32301*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TESTING OF HIGH-VOLTAGE SPACECRAFT SYSTEMS IN A SIMULATED IONOSPHERIC PLASMA
D. R. Burrowbridge *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 131-138 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09C

The ion trap design for an experiment package for OAO was studied in a simulated ionospheric plasma. The light baffle in the device was modified to eliminate ions from the detector region. In tests of other devices, interactions were also observed between electrical systems and the plasma and are believed to contribute to some of the malfunctions and failures in orbiting spacecraft. R.B.

N70-32302*# Martin Marietta Corp., Denver, Colo.
ROCKET-EXHAUST INITIATION OF CONDUCTION IN CONNECTORS AT ALTITUDE
R. W. Ellison *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 139-154 (See N70-32286 17-09)
Avail: CFSTI CSCL 09C

The initiation of destruct circuits at staging of several spacecraft boosters due to the exhaust plume of retrorockets is considered. Tests in altitude chambers with pressure cartridges designed to simulate the exhaust of retrorockets are reported. Conduction between connector pins exposed to these exhausts was observed and it was discovered that conduction from the pressure cartridge to the target connector was more likely than conduction between adjacent pins. The need for definitive experimental investigation of the values of electron concentration sufficient to initiate conduction in connectors is emphasized. Author

N70-32303*# Harvard Coll. Observatory, Cambridge, Mass.
HIGH-VOLTAGE BREAKDOWN IN AN OSO-4 POINTED EXPERIMENT

N. L. Hazen, M. C. E. Huber, and E. M. Reeves *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 155–168 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09C

A scanning spectrometer placed at the focus of a single-element reflecting telescope aboard OSO-4 is described and the high-voltage breakdown of the instrument is discussed. The preflight test background and failure analysis of the instrument are presented. Recommendations are made for manufacturing techniques and acceptance tests to prevent future failures. R.B.

N70-32304*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE PREVENTION OF ELECTRICAL BREAKDOWN IN SPACECRAFT
F. W. Paul and D. R. Burrowbridge *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 169–176 (See N70-32286 17-09)
Avail: CFSTI CSCL 09C

The manual provides guidance for designers and fabricators of high-voltage equipment for space applications to avoid failures caused by electrical breakdown. The breakdown phenomena in gases are discussed with respect to Paschen's law, breakdown in homogeneous fields, time lags for breakdown, dc discharge types, and breakdown in alternating fields. Tables are also provided for factors involved in breakdown phenomena in liquids and solids. R.B.

N70-32307*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RF VOLTAGE BREAKDOWN IN COAXIAL TRANSMISSION LINES
R. Woo *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 189–192 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09C

Two experimental setups consisting of a 10 to 150 MHz lumped circuit test set and 150 to 800 and 1700 to 2400 MHz transmission line test sets were used to measure ionization breakdown. Multipacting breakdown data corresponding to the lower breakdown boundary are included along with ionization breakdown data. R.B.

N70-32308*# Stanford Research Inst., Menlo Park, Calif.
REDUCTION OF GAS-DISCHARGE BREAKDOWN THRESHOLDS IN THE IONOSPHERE DUE TO MULTIPACTING
G. August and J. B. Chown *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 193–202 (See N70-32286 17-09)
Avail: CFSTI CSCL 04A

The phenomenon of multipacting is defined in terms of electrode spacing and secondary electron emission. Data are presented from measurements of electron densities and heating resulting from a gas discharge responsible for multipacting. Possible multipactor conditions are described and listed in tabular form. R.B.

N70-32309*# General Electric Co., Philadelphia, Pa.
THE EFFECTS OF OUTGASSING MATERIALS ON VOLTAGE BREAKDOWN
J. F. Scannapieco *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 193–212 (See N70-32286 17-09)
Avail: CFSTI CSCL 09C

Some of the basic equations which regulate outgassing are reviewed and their dependence on temperature and thickness are shown. An analogy is made between mass transfer or outgassing and radiant heat transfer, and it is shown how a computer program written for radiant heat transfer is used to determine the condensation rate caused by mass transfer. The effects of outgassing are considered as phenomena of condensation and corona discharge. A hypothetical black box is used as a simplified illustration. Author

N70-32511*# Texas Instruments, Inc., Houston.
THE DEVELOPMENT OF QUALITY STANDARDS FOR BIPOLAR LSI, VOLUME 1 Final Report, 15 Apr. 1969–15 Apr. 1969
Nov. 1969 62 p
(Contract NAS8-21319)
(NASA-CR-102598; TI-03-70-29) Avail: CFSTI CSCL 09C

Various test programs were initiated to identify failure mechanisms and this resulted in finalization of the package design and multilevel metallization techniques. Areas of further work in the development of quality standards and inspection criteria for bi-polar LSI devices are suggested. Author

N70-32672*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ELECTRIC FIELD HYSTERESIS EFFECTS IN THE TRANSMISSION PROPERTIES OF LIQUID CRYSTALS
Louis Melamed and David Rubin Washington Jul. 1970 7 p refs
(NASA-TM-X-2044; C-108) Avail: CFSTI CSCL 20B

Certain room temperature cholesteric liquid crystals are capable of retaining information on their past history of electric field excitation by exhibiting marked changes in their optical transmission properties. The information retention slowly decays, but, in many cases, persists for at least several days following the removal of excitation. Thus, 100 volts applied across a 25 micron sample for 10 minutes caused a change in transmission at 5000A from 75 percent to about 22 percent. Sixty hours later, the transmission was about 48 percent. Author

N70-32682*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
DESIGN EVALUATION OF DISTRIBUTED SATURATION CHARACTERISTICS IN INTEGRATED DEVICES
W. W. Happ and L. B. Dickson Washington 17 p refs
(NASA-TN-D-5889; C-129) Avail: CFSTI CSCL 09A

To evaluate the characteristics of an integrated circuit transistor operating in the saturated mode, it is necessary to determine the parameters for the distributed model. In addition, the latersal currents in the base and collector regions cause corresponding variations in the junction potentials. Formulas are given for the series collector resistance, and it is shown that normalized "A" parameters can be measured and will be constant for a given impurity profile. The difference equations are solved with the aid of a computer. The solutions give not only the terminal saturation characteristics but also the internal current densities. Comparison of experimental values of the saturation characteristics with theory shows excellent agreement. Author

N70-32908*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
DEVELOPMENT OF A MODEL FOR DISTRIBUTED SATURATION CHARACTERISTICS IN INTEGRATED DEVICES
W. W. Happ and L. B. Dickson Washington Jul. 1970 17 p refs
(NASA-TN-D-5888; C-128) Avail: CFSTI CSCL 09E

The characteristics of an integrated circuit transistor, operating in the saturated mode, cannot be determined from simple lumped

parameter relationships. Due to the geometry of these transistors, the series collector resistance must be calculated using conformal mapping techniques. To accurately determine the saturation characteristics, distributed models are developed for the five regions of the transistor. Using these models as a guide, difference equations describing each region are formulated. Insight into the operation of the transistor can be gained by examining the internal current densities predicted by the model. Author

N70-33092*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORCE-REDUCED SUPERCONDUCTING TOROIDAL MAGNET COILS
Roger W. Boom (Atomics Intern.) and James C. Laurence Washington Jul. 1970 28 p refs
(NASA-TM-X-2054; E-5085) Avail: CFSTI CSCL 20C

Two force reduced toroids have been built with copper plated niobium-zirconium superconductor wire. The dimensions of the toroids are 30.5 cm major diameter and 3.2 cm minor diameter. The design goal was that each wire should be in a field longitudinal to within + or − 15 deg. The objective was to determine if advantage can be gained from the unusually high current capacity of a common type 2 superconductor in longitudinal fields for the design of magnets. The result found is that a force reduced toroid of 0.025 cm diameter niobium - 25 percent zirconium wire will carry 63 A. This current is to be compared with the usual 18 to 20 A current carried by solenoids built with similar wire. The results are also to be compared with short sample critical currents of approximately 176 A for the same wire in longitudinal fields. Preliminary reports of these magnets have been presented. A smaller toroid, 30.5 cm major diameter and 2 cm minor diameter, constructed in a similar fashion carried a maximum of 62 A. Author

N70-33093*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-VOLTAGE ARC AND BREAKDOWN EFFECTS IN XENON-FILLED THERMIONIC DIODES
Ralph Forman Washington Jul. 1970 11 p refs
(NASA-TM-X-2051; E-5644) Avail: CFSTI CSCL 20C

Breakdown phenomena and the low voltage xenon arc have been studied in xenon filled thermionic diodes. These measurements were made at gas pressures ranging from 1 torr to atmospheric pressure and with diodes having interelectrode spacings of 0.05, 0.10, and 0.75 centimeter. Most of the results were obtained on tubes with an unipotential, thoriated tungsten cathode operating at approximately 1700 C. The results showed that breakdown in xenon leading to the low voltage arc can occur at voltages even lower than the first excitation potential of xenon. No minimum spacing effect was observed, the low voltage arc occurred for interelectrode spacings down to 0.05 centimeter. At a spacing of 0.05 centimeter and a cathode temperature of 1700 C, the low voltage xenon arc could be induced over the pressure range of 1 to 500 torr. Under some conditions of pressure and spacing, the low voltage xenon arc could be sustained at voltages as low as 1 to 2 volts. Author

N70-33277*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL OF ELECTRONIC CIRCUIT DESIGNS FOR SPACE VEHICLES
O. James Magrini Washington Jul. 1970 15 p refs
(NASA-TN-D-5920; E-5460) Avail: CFSTI CSCL 09C

A technical management procedure that is directed to the design of a complex electronic system for space environment applications is described. The procedure was developed by the NASA Lewis Research Center and applied to the Centaur launch vehicle program. Specific controls used include a complete hierarchy of specifications, design ground rules, derating document, preferred parts list, worst case design procedure, computer circuit analysis programs, and design reviews. The use of these rigorous design controls resulted in an electronic system capable of meeting its performance and reliability goals with a minimum of difficulty. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-32061# ARO, Inc., Arnold Air Force Station, Tenn.
ABLATION TESTING IN HOT AND COLD COAXIAL JETS. PHASE 1: COLD FLOW FEASIBILITY TESTS Final Report, Jul. 1968 – Nov. 1969
R. D. Herron Arnold Eng. Develop. Center Apr. 1970 53 p refs
(Contract F40600-69-C-0001)
(AD-704545; AEDC-TR-70-64) Avail: CFSTI CSCL 14/2

An investigation was conducted to determine the feasibility of extending the capability of ablation test facilities by surrounding the high enthalpy flow with a coaxial cold air jet. The investigation included both analytical and cold flow experimental studies. It was determined that the coaxial flow technique is extremely promising, offering the potential of easily doubling the facility model size capability. Results of the cold flow experimental tests and criteria for application of the technique to high enthalpy facilities are presented. Author (TAB)

N70-32233# Singer-General Precision, Inc., Binghamton, N.Y. Link Div.
AUTOMATED INSTRUCTION AND PERFORMANCE MONITORING IN FLIGHT SIMULATOR TRAINING Final Report, Dec. 1968 – Aug. 1969
Victor Faconti, Charles P. L. Mortimer, and Duncan W. Simpson Feb. 1970 397 p refs
(Contract F33615-69-C-1159)
(AD-704120; LR-220; AFHRL-TR-69-29) Avail: CFSTI CSCL 5/9

The report documents research in the area of automated instruction and performance monitoring. One objective of the research was to develop modular approaches to implementing eight individual automated training capabilities in flight simulators. Several approaches to each area are identified and briefly investigated. More complete investigation, including programming flow diagrams and hardware and software estimates, is presented on those approaches in each capability area which appeared to be most feasible. Two integrated systems, i.e. systems which include all eight automated training capabilities, are described. Several methods of implementation, in relation to the computer complex, are presented. Author (TAB)

N70-32366# Language Service Bureau, Inc., Washington, D.C.
ECONOMIC STUDIES AND SOME TEST RESULTS FROM FOG DISSIPATION SYSTEMS IN FRANCE Final Report
Apr. 1970 64 p Transl. into ENGLISH of Secretar. Gen. a l'Aviation Reports No. 1, 2, 3, and 4 Prepared for FAA
(FAA-RD-70-16; Rept-1; Rept-2; Rept-3; Rept-4) Avail: CFSTI

This report consists of the following four separate studies: (1) fog dispersal operations on supercooled fog (temperature less

than 0 C) at Orly confirmed that 0 C is the efficiency threshold for a ground base device utilizing liquid propane sprayers; (2) description of past and present installations at Orly for dispersing positive fog (temperature greater than 0 C) using the French turboclair method; (3) economic factors to demonstrate that the present installation at Orly for dispersing positive fog can be profitable; and (4) economic factors to demonstrate that future turboclair installations can be profitable. Author

N70-32546# National Aviation Facilities Experimental Center, Atlantic City, N.J.

SIMULATION STUDY OF TWO SITES FOR A THIRD CHICAGO METROPOLITAN AIRPORT Final Report

Sidney B. Rossiter Jul. 1970 114 p refs

(FAA-RD-70-25; FAA-NA-70-34) Avail: CFSTI

A dynamic simulation study to assess the relative merits of two proposed sites for a third major airport in the Chicago area was conducted. Considered were the traffic flows of the three major airports and either of the proposed sites, under three different landing/takeoff directions. It was concluded that on a system vs. system basis, there was no statistical preference for either site when the three wind configurations were considered equal in weight. The land site system was less efficient than the lake site system in the arrival operation of the Northeast configuration. The lake site system was less efficient than the land site system in both the arrival and departure operations of the Southeast configuration. It was further concluded that on a system basis, in all configurations tested, the airspace as employed by both site plans was able to accommodate the amount of traffic which could be generated by the three airports. Author

N70-32560# Lockheed-California Co., Burbank.

AIRCRAFT DYNAMIC WHEEL LOAD EFFECTS ON AIRPORT PAVEMENTS Final Report, May 1969 – May 1970

J. E. Wignot, P. C. Durup, G. Wittlin, R. B. Scott, and M. A. Gamon May 1970 437 p refs

(Contract FA-69-WA-2143)

(FAA-RD-70-19; LR-23307) Avail: CFSTI

The study included scaled pavement tests, analyses to determine airplane imposed loads on pavement and pavement response, correlation between empirical data and analyses, and a literature review. The results of the investigation indicate that the two distinguishable effects that influence the stress on pavements are airplane induced loads and moving load phenomenon. For a given level of runway unevenness the loads that will be imposed on the pavement can be accurately defined for various ground operations performed. However, the pavement response to a moving load can vary substantially depending upon the kinds of materials and types of construction used. To obtain proper assessment of moving load effects, full scale pavement tests are considered necessary to provides needed data. Two test plans are presented. One approach involves operational statistical tests and depends upon a heavy statistical sample of data. The alternate approach involves moving load track tests and provides data for point-by-point correlation using analytical data under carefully controlled conditions and configurations. Author

N70-32610*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL LIFT INTERFERENCE ON SWEPTBACK WINGS IN RECTANGULAR TEST SECTIONS WITH SLOTTED SIDE WALLS

Ray H. Wright and James D. Keller Washington Jul. 1970 17 p refs

(NASA-TR-R-344; L-7138) Avail: CFSTI CSCL 14B

A theory is presented for the boundary-induced upwash interference on a sweptback wing mounted in a rectangular wind-tunnel test section with closed top and bottom walls and slotted side walls. The interference factor can be computed at any point in the test section. In an example, the interference with slotted side walls is compared with that with slotted top and bottom walls. Author

N70-32650# Naval Postgraduate School, Monterey, Calif.

DEVELOPMENT OF A SIMULATOR FOR THE EVALUATION OF RIGID AND MOVABLE AIRCRAFT CONTROLS

David White Caswell (M.S. Thesis) Jun. 1969 49 p refs

(AD-703638) Avail: CFSTI CSCL 1/3

A simulator was constructed with two sets of aircraft controls: one set was movable and one set was rigid. The control output signals were integrated into an analog computer circuit to provide the desired aerodynamic characteristics. A repeatable, random input voltage to an oscilloscope was used as a basis for a tracking exercise in which the test subject, by manipulation of the control stick, attempted to cancel the random signal. A scoring method was devised which utilized an electronic counter and signal comparator to evaluate pilot performance with each of the four control sticks. Author (TAB)

N70-32750# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.

LEAK TESTING AND REPAIR OF HIGH EFFICIENCY PARTICULATE AIR FILTER BANKS

J. R. De Monbrun and E. E. Choat 12 Mar. 1970 15 p refs Presented at Am. Assoc. for Contamination Control No. 7, Chicago, 13-16 May 1968

(Contract W-7405-eng-26)

(Y-JA-33-Rev-2) Avail: CFSTI

The program for handling, installing, and testing high-efficiency particulate air (HEPA) filters is described. Quality assurance testing, inspection and installation, the HEPA filter frame design, in-place efficiency testing, in-place leak testing, and repairs and modifications to stop leaks are discussed. NSA

N70-32832# TRI-Univ. Meson Facility, Vancouver (British Columbia).

CONCEPTUAL DESIGN STUDY FOR THE TRIUMF CONTROL AND SAFETY SYSTEM

Dec. 1969 83 p refs

(TRI-69-8) Avail: AEC Depository Libraries

A general philosophy for the control of the TRIUMF facility is presented. The hard-wired personnel safety system is based on a system of controlled access areas. Radiation levels throughout the facility are routed through area safety units to central control. Violation of a personnel interlock results in interruption of the beam delivery to the entire facility. A change in radiation levels beyond prescribed limits will also interrupt beam delivery. The machine safety system is based on beam characteristics. Both relative and absolute beam intensity limits are proposed. A beam shut-off time of about 300 microseconds is adequate for machine protection, while personnel protection requires the shortest possible beam shut-off time. A computer-based scanning and digitizing system permitting fast and flexible data processing is proposed for the ion source and injection system. The radio frequency will be a fixed reference to, which the main magnet field is controlled. Author (NSA)

N70-32868*# American Science and Engineering, Inc., Cambridge, Mass.

AN APPARATUS TO STUDY COLLISIONS OF IONIZED AND NEUTRAL PARTICLES WITH GASES AT METEORIC VELOCITIES

Roderick D. Swift Jun. 1970 135 p refs

(Contract NAS12-143)

(NASA-CR-86395; ASE-2446) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740

An apparatus built to measure the spectra and the absolute emission cross sections for light produced in particle collisions at meteoric velocities is described. The term emission cross section is used because the observed radiation may be the result of a cascade process as well as direct excitation to the parent level. Both ion-neutral and neutral-neutral collisions can be studied, and the calibrated spectral range is 2500 A to 8000 A. Detailed descriptions of the apparatus are given. In order to check the performance of the apparatus, a number of experiments were done. These included spectral measurements, from which relative cross sections may be deduced, for Fe(+) ions impinging on gas targets (N2, O2, air and Ar). Spectra and cross sections were also measured for Ar(+) + Ar in order to compare results with those published by other research groups. The energy dependence of the cross sections for emission of the 4610 A and 4765 A lines of Ar(+) during He(+) + Ar collisions was studied in detail from threshold to 2000eV ion energy. Finally, a beam of neutral N2 at 900 eV was produced by a charge-exchange process and its intensity measured. The results of some of the above experiments have been published, and references are given. Computational procedures for cross section measurements are also described. Author

N70-32870# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
SLINGSHOT: AN ADVANCED AERODYNAMIC TEST FACILITY
M. H. Bloom, R. J. Cresci, G. Moretti, and J. Librizzi Jun. 1969 30 p ref Presented at the 7th Intern. Shock Tube Symp., Toronto, 23-25 Jun. 1969
(Nonr-839(38); ARPA Order 529; Proj. Strategic Technol.)
(AD-702052; PIBAL-69-24) Avail: CFSTI CSCL 14/2

A conceptual view is presented of the SLINGSHOT method of mechanically setting fluids or other materials into motion with respect to models. In the special context of gas-dynamic testing, unpre-processed test gas is made available at high Reynolds numbers and high Mach numbers with fixed models. Performance in regimes now inaccessible with fixed models is theoretically possible; however, practical implementation may require significant effort. Exploratory experiments made with the simplest conceivable apparatus show agreement with estimated model pressures and running times. The basic setup now consists of a gas-gun accelerated capsule containing the test gas, 2 in. dia. x 12 in length, which has been driven to 3600 fps. An analysis of the internal wave behavior agrees with the experimental observation indicating the absence of shocks within the test gas. Among the main problems are running-time limits, booster simplicity, and disposal of capsule debris. Examination of somewhat higher performance conditions appears warranted. Author (TAB)

N70-32875*# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF AN IMPROVED GASEOUS OXYGEN IMPACT TEST SYSTEM Final Report, 10 Jun. 1969 – 10 May 1970
W. R. Blackstone Jul. 1970 22 p refs
(Contract NAS9-9543; SwRI Proj. 03-2631)
(NASA-CR-108529) Avail: CFSTI CSCL 14B

Consultative services provided are described in a program to develop an improved gaseous oxygen impact test system. The services provided included a critical evaluation of background information derived from related tests already in use, general consultations in the areas of material compatibilities with liquid and gaseous oxygen, assistance in the areas of equipment design and impact test procedures. Author

N70-32983# Princeton-Pennsylvania Accelerator, Princeton, N.J.
ANALOG DATA BREAK INTERFACE
J. M. Henness 30 Oct. 1969 19 p Presented at IEEE Nucl. Sci. Symp., 1969
(Contract AT(30-1)-2137)
(PPAD-669-E) Avail: CFSTI

The interface used for on-line control of the Princeton-Pennsylvania Accelerator with a PDP-9 is described. The specifications for the equipment are considered. The requirements are unique because of the cyclic nature of the synchrotron. Various I/O techniques and the design compromises they require are discussed and the concept of an analog data break interface is outlined. A summary of existing and planned hardware is presented. Author (NSA)

N70-33018# Kernforschungszentrum, Karlsruhe (West Germany).
COLLECTIVE EFFECTS IN CIRCULAR ACCELERATORS [KOLLEKTIV-EFFEKTE IN KREISBESCHLEUNIGERN]
A. A. Kolomenskiy et al 1968 28 p refs Transl. into GERMAN from Russian preprint In GERMAN Presented at Natl. Particle Accelerator Conf., Moscow, 9-16 Oct. 1968
(KFK-tr-302; Conf-681029-2) Avail: AEC Depository Libraries

A bibliographic review is presented on the experimental studies on collective effects in circular accelerators. NSA

N70-33037# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
RESEARCH FACILITIES AT CRNL
Feb. 1970 24 p refs
(AECL-3555) Avail: AEC Depository Libraries

Existing cooperation, health and safety, radiation protection, and experimental facilities including the tandem accelerator, reactor beam holes, in-core irradiation facilities, gammacell, electron microscope, Van de Graaff accelerators, mass separator, 2 MeV Febetron, and the ESR spectrometer are briefly discussed. Also, biology and health physics research, materials science, reactor physics research, and engineering test facilities are outlined. NSA

N70-33078# Battelle-Northwest, Richland, Wash. Applied Physics Dept.
FAIL SAFE INSTALLATION OF A VACUUM SYSTEM FOR SPUTTERING APPLICATIONS IN A GLOVE BOX
W. J. Coleman Feb. 1970 31 p
(Contract AT(45-1)-1830)
(BNWL-1287) Avail: CFSTI

In the development of a method to contain polonium as an isotopic heat source the hollow microsphere concept was originated. In order to make this concept work many new fabrication processes were required. One of these processes involved sputtering and vacuum evaporation techniques. Due to the biological hazard, it was mandatory that the equipment be operated in a fail safe condition. The procedures involved in installing a vacuum system into a radiation glove box and the modifications necessary to install a sputtering unit in this box are discussed. A major consideration in the installation of the vacuum system and sputtering unit in the radiation glove box was to provide a mechanism so that any malfunction would result in immediate shut down. That is to say, that if the power or any one of the components failed, the unit would shut down in such a way that no release of radioactive material would occur. The box in normal operation is maintained at −1 in. of water. All mechanisms fail in such a manner as to maintain this negative pressure in the box. Author (NSA)

N70-33189# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
A 3 MeV PROTON BEAM OF LESS THAN FOUR MICRONS DIAMETER
J. A. Cookson and F. D. Pilling Jan. 1970 10 p refs
(AERE-R-6300) Avail: AEC Depository Libraries; HMSO £2; BIS $7.38

A focusing system using high precision magnetic quadrupoles was designed and built for use with the IBIS Van de Graaff generator. Measurements of the first order focusing and the aberrations agreed satisfactorily with theoretical predictions. The focused beam of 3 MeV protons was measured to have a diameter of less than 4 micrometers. Author (NSA)

N70-33278# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH-VACUUM CONDENSER TANK FOR ION ROCKET TESTS Patent

J. Howard Childs and William R. Mickelsen, inventors (to NASA). inventors Issued 13 Nov. 1962 (Filed 24 Sep. 1959) 3 p Cl. 73-116

(NASA-Case-XLE-00168; US-Patent-3,063,291; US-Patent-Appl-SN-842170) Avail: US Patent Office CSCL 14B

A vacuum tank for testing ion rockets at pressures of 10 to the minus 7 mm Hg and below is described. The tank maintains the required pressure with two oil diffusion pumps. Cooled condenser baffles are employed to freeze the rocket exhaust, which eliminates the need for pumping it. R.B.

N70-33287* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND TUNNEL AIRSTREAM OSCILLATING APPARATUS Patent

Laurence K. Loftin, Jr., inventor (to NASA) Issued 24 Oct. 1961 (Filed 28 Sep. 1959) 5 p Cl. 73-147

(NASA-Case-XLA-00112; US-Patent-3,005,339; US-Patent-Appl-SN-843022) Avail: US Patent Office CSCL 14B

This invention relates generally to a wind tunnel air flow modulating device, and more particularly to apparatus for selectively generating wave motion in the air flow of a wind tunnel. This involves a new and improved vane system for generating downwash wave motion in a wind tunnel airstream, and an actuating apparatus connected between the vane system and a suitable driving device. M.G.J.

N70-33292# Kernforschungszentrum, Karlsruhe (West Germany). Datenverarbeitungszentrale.

OPERATION SYSTEM FOR MANY-FOLD ACCESS IN LABORATORY AUTOMATION [EIN BETRIEBSSYSTEM FUER DEN VIELFACHZUGRIFF IN DER LABORAUTOMATISIERUNG]

G. Krueger Jul. 1969 22 p In GERMAN

(KFK-929) Avail: AEC Depository Libraries

The following conditions must be fulfilled: (1) control of the plotting process in the DV installation by data from the outside station. The data originating from the various sources (experimentors, measurement apparatus, and small DV installations) must be treated similarly. In this way a stepwise increase of the degree of automation is possible and a great flexibility is assured; (2) coordination of the various activities by a planning and safety program running the preferable mode. Of great significance for the step-by-step planning is the maintenance of asserted reaction times of the DV system in critical experimental events; (3) dynamic control of the experimental course according to intermediate results in the framework of guide lines previously given by the experimentor; (4) extensive freedom in the planning, programming, and operation of the very differently experimentally oriented programs with suitable control and operation functions. The first version of the operational program is in the test stage. Author (NSA)

N70-33293# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.

CONCEPTION OF PROTECTION IN INSTALLATIONS SUBJECT TO HAZARD OF CRITICALITY. TEST OF ACTIVE MATERIALS NEAR A SOURCE REPRODUCING A REAL ACCIDENT

G. Benezech, A. Gey, C. Renard, and P. Lecorche [1969] 15 p refs In FRENCH Presented at the Symp. on Radiation Safety Probl. in the Design and Operation of Hot Facilities, Saclay, France, 13 – 17 Oct. 1969

(CEA-CONF-1420; SM-125/10; CONF-691008-4) Avail: AEC Depository Libraries

The concept of protection in installations subject to criticality hazards is outlined with a consideration of the general philosophy, equipment criteria, possible evolution of the philosophy, and detection and alarm-criticality networks. The types of detectors and the processing of the data received from them are summarized. Tests made on real detection materials near a source reproducing real accidents are reported. Two possible solutions to the inadequacies of the present coincidence system are proposed. NSA

N70-33294# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

WATER AND AIR TIGHT DOORS FOR BETA-GAMMA ENCLOSURES

J. Fradin [1969] 17 p In FRENCH Presented at the Symp. on Radiation Safety Probl. in the Design and Operation of Hot Facilities, Saclay, France, 13 – 17 Oct. 1969

(CEA-CONF-1424; SM-125/17; CONF-691008-9) Avail: AEC Depository Libraries

The water and air tight doors constitute one of the principal elements of installations for the manipulation of radioactive materials. Two doors, which solve some of the practical problems of exploitation of such enclosures, are described. The first is a transfer door which can be installed either directly on the enclosure or on a transfer base. The second is a door for the admission of the radioactive materials. Each door is described in detail with the use of sketches and illustrations. NSA

N70-33296# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

NORMALIZED SYSTEM FOR TECHNICAL MEANS OF PROTECTION AND IMPROVEMENT OF SAFETY IN HOT LABORATORIES

Jean Vertut, Robert Seran, and J. P. Guilbaud [1969] 24 p In FRENCH Presented at the Symp. on Radiation Safety Probl. in the Design and Operation of Hot Facilities, Saclay, France, 13 – 19 Oct. 1969

(CEA-CONF-1426; SM-125/50; CONF-691008-15) Avail: AEC Depository Libraries

The progress made in France in the development of normalized systems for shielding, remote handling, transfer, monitoring, and fire safety in hot laboratories is summarized. The bases of the normalized materials system are given. The normalized elements in shielding, air tightness and tight transfer, shielded containers and shielded transfer elements, and handling methods are also described. NSA

N70-33310# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.

MAINTENANCE OF VENTILATION INSTALLATIONS. INFLUENCE OF THE MEANS OF REGULATION (GATE VALVES, DAMPERS, PIPES) AND OPENINGS, AIR LOCKS, ETC., ON THE DISPERSION OF THE CONTAMINATION. EXPERIENCE ACQUIRED IN THE FIELD IN THE VARIOUS INSTALLATIONS

R. Salle, H. Conrad, and A. Quilichini [1969] 21 p refs In FRENCH Presented at the Symp. on Radiation Safety Probl. in the Design and Operation of Hot Facilities, Saclay, France, 13 – 19 Oct. 1969

(CEA-CONF-1421; SM-125/11; CONF-691008-14) Avail: AEC Depository Libraries

Several cases of effective or potential contamination are described and the means for correcting the faults observed in the CEA installations are indicated. These faults included: mistakes in the design of the motor-driven ventilator controls which permitted reversing the air circulation direction between various locations; pressure differences in branches of the ventilating system, which varied with the output, and could reverse the direction of air circulation; bad selection of ventilators used simultaneously in parallel, which could cause overpressure of the installation in case of partial motor failure; heat releases in a high activity cell, thereby expelling the contaminated air to the opening of a roof plate; loss of efficiency of filters caused by a shunting leak; passage of air between two groups of locations ventilated by different ventilation installations; gel or frosting of the external air intakes which results in low pressures in the ventilated locations; and danger of recycling by a chimney receiving the air extracted by several independent ventilation systems. Author (NSA)

N70-33329* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RUNWAY LIGHT Patent
Sidney A. Batterson, inventor (to NASA) Issued 16 May 1961 (Filed 24 Sep. 1959) 5 p Cl. 240-1.2
(NASA-Case-XLA-00119; US-Patent-2,984,735; US-Patent-Appl-SN-842171) Avail: US Patent Office CSCL 01E

A runway light unit is described which has a buried receptacle with a light source inside and a hinged reflector surface which can be either level with the runway or at an angle above it. A spring normally maintains the reflector surface at an angle, but permits it to be leveled if hit by an aircraft or other colliding object. The surfaces may be retracted when not needed. The lights may be placed in any desired pattern, and used in pairs with the lights positioned to illuminate in opposite directions. N.E.N.

N70-33341# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Heisse Chemie.
INVESTIGATION OF THE ACCOUNTABILITY TANK OF REPROCESSING FACILITY [UNTERSUCHUNGEN AM EINGANGSMESSTANK EINER WIEDERAUFARBEITUNGSANLAGE]
B. F. Roth, W. Lindner, and P. Fischer Oct. 1969 70 p refs In GERMAN
(KFK-996) Avail: AEC Depository Libraries

Calibration and operation values were determined for use in construction of the accountability tank. Calibration of a ring container using an ascending tube is described, along with volume determination by the air bubble method. Investigations were made of the ejector diffusion pump. NSA

N70-33365# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
ACCELERATION OF DEUTERONS IN A 60-GeV PROTON SYNCHROTRON [BESCHLEUNIGUNG VON DEUTERONEN IN EINEM 60 GeV PROTONENSYNCHROTRON]
W. Heinz and H. Pilkuhn Nov. 1969 24 p refs In GERMAN; ENGLISH summary
(KFK-1087) Avail: AEC Depository Libraries

An accelerator study group has proposed to build a 60 GeV separated function synchrotron. Possible experiments with accelerated deuterons are discussed, and several alternatives for deuteron acceleration in the proposed machine are considered. It was found that practically without extra cost 10 to the 12th power pulse can be accelerated. An improved version can deliver about 10 to the 13th power d/pulse. Author (NSA)

N70-33368# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
INFLUENCE OF STATISTICAL ERRORS ON THE STABILITY OF LONGITUDINAL PHASE OSCILLATIONS OF A LINEAR ACCELERATOR (FLATNESS-PROBLEM) [EINFLUSS STATISTISCHER STOERUNGEN AUF DIE STABILITAET LONGITUDINALER PHASENSCHWINGUNGEN BEI EINEM LINEARBESCHLEUNIGER]
Elmar Sauter Jul. 1969 30 p refs In GERMAN; ENGLISH summary
(NP-18154) Avail: AEC Depository Libraries

The influence of random errors caused by construction and adjustment tolerances on the size of the stability region of longitudinal phase-oscillations are investigated analytically and numerically. The linear approximation necessary for the analytic treatment leads to the stability problem of an harmonic oscillator, whose frequency changes at random. No influence is found on that region of the phase-plane, which is used for acceleration, even for relatively large initial errors. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-32004*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF SUPERSONIC CONICAL FLOWS
C. W. Chiang and Richard D. Wagner Jr. Washington Jul. 1970 35 p refs
(NASA-TN-D-5884; L-7082) Avail: CFSTI CSCL 20D

An analytical technique is described for conical flow-field predictions for a particular class of flows. Problems of accelerating and decelerating supersonic cross flows are considered; the accelerating cross flow is produced when the free stream is normal to the conical axis of symmetry (a fin or stabilizer), and the decelerating cross flow is produced when the free stream is in the plane of symmetry (delta wing). For the first problem the solution is complete; for the latter only the solution for the supersonic cross-flow region is presented. The fundamental differential equations are transformed into a dimensionless conical coordinate system. Since the partial differential equations governing a conical flow field are of hyperbolic type in regions of supersonic cross flow, the method of characteristics can be applied. The characteristic equations and compatibility equations are derived. Numerical computations are performed, starting from the leading edge and proceeding to the central portion of the wing. Author

N70-32015# Army Natick Labs., Mass.
NEW TABLES FOR AIR FLOW
Harold J. Hoge Mar. 1970 57 p refs
(AD-703890; USANLABS-TR-70-50-PR) Avail: CFSTI CSCL 20/4

New tables for the compressible flow of air were prepared, based on I-dimensional flow with k = 1.4. A new dimensionless force variable is introduced and it is shown that this variable is independent of the stagnation pressure of the flow. This feature makes the new tables applicable to flows of different stagnation temperatures and pressures in much the same way that conventional tables are applicable to flows of different stagnation temperatures only. The tables are divided into white regions, in which linear interpolation can introduce error. Author (TAB)

N70-32040# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.
A SOLUTION FOR GAS-PHASE RECOMBINATION AND DISSOCIATION IN THE LAMINAR BOUNDARY LAYER OF A FLAT PLATE Final Report, Sep. 1967 – Sep. 1969
Robert J. Vidal Arnold Air Force Station, Tenn. Arnold Eng. Develop. Center Apr. 1970 30 p refs
(Contract F40600-69-D-0005)
(AD-704546; CAL-AF-2753-A-1; AEDC-TR-70-110) Avail: CFSTI CSCL 20/4

An existing theory for predicting the onset of dissociation in a laminar boundary layer is generalized and extended to account for dissociation in the boundary layer and gas-phase recombination near a cold wall. The existing theory shows that dissociation first occurs in a thin layer centered on the maximum temperature in the boundary layer. The present extension shows that for cold walls, there will be a dense layer near the wall with relatively long particle residence times to promote recombination. Hence, at least initially, the reacting boundary layer on a cold wall is characterized by a dissociation layer embedded in the boundary layer and a recombination layer near the wall. The theory is derived without specifying the gas model, and numerical results are given which are based upon a realistic gas model. It is shown that the effects of dissociation and recombination tend to compete, and under certain conditions the effects at the wall tend to cancel. Author (TAB)

N70-32042# Lockheed Missiles and Space Co., Palo Alto, Calif.
INTERACTION BETWEEN A SPHERICAL WAVE AND A CIRCULAR CYLINDRICAL SHELL IN AN ACOUSTIC MEDIUM
V. D. Kubenko 1970 4 p refs Transl. into ENGLISH from Dopo. Akad. Nauk Ukr. RSR Ser. A (Kiev), no. 3, 1970 p 251 – 254
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An elastic circular cylindrical shell on which a spherical wave is incident is considered by applying Fourier and Laplace transforms to the Vlasov equations of shell theory. It is shown that if the analysis is limited to the initial stages of the interaction, it is possible to utilize asymptotic representations of cylinder functions for large values. F.O.S.

N70-32044*# Scripta Technica, Inc., Washington, D.C.
USE OF A SHOCK TUBE TO INVESTIGATE DIFFUSERS [PRIMENENIYE UDARNOY AERODINAMICHESKOY TRUBY DLYA ISSLEDOVANIYA DIFFUZOROV]
V. M. Anufriyev et al NASA July 1970 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 2, Mar. – Apr. 1969 p 117 – 120
(Contract NASw-2036)
(NASA-TT-F-12603) Avail: CFSTI CSCL 20D

Study of the performance of a diffuser in a shock tube for nitrogen flow at Mach 8 and a Reynolds number of 10(6). The time for the formation of a steady shock wave and that for the development of a separation zone are determined by high speed photography. The effectiveness of the application of shock tubes for diffuser start-up procedures is indicated. Author

N70-32046*# Techtran Corp., Glen Burnie, Md.
CALCULATION OF THE SECOND VIRIAL COEFFICIENT OF DISSOCIATING GAS [K RASCHETU VTOROGO VIRIAL'NOGO KOEFFITSIENTA DISSOTSIIRUYUSHCHEGO GAZA]
P. M. Klepatskiy et al Washington NASA Jul. 1970 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 13, no. 12 p 1073 – 1075
(Contract NASw-2037)
(NASA-TT-F-13101) Avail: CFSTI CSCL 20D

The equation of state of a dissociating imperfect gas is represented in the form of a virial series by powers of the number of initial particles per unit volume. It is also represented in standard form for a mixture of monomers and dimers. The numerical values of the coefficients of the temperature series coincide absolutely with previously published results. Author

N70-32088# California Univ., Berkeley. Div. of Aeronautical Sciences.
LAMINAR SUPERSONIC FLOW IN NEAR WAKES AT HIGH VALUES OF REYNOLDS NUMBER
M. Y. Hussaini Mar. 1970 67 p refs
(Contracts Nonr-222(79); N00014-69-0200-1020)
(AD-705126; AS-70-1) Avail: CFSTI CSCL 20/4

The studies of subsonic and supersonic wake flows are reviewed. A systematic technique of obtaining non-similar solutions to the boundary layer equations governing the laminar compressible mixing behind a finite base is developed and applied to the case of supersonic base flow. Chapmans similarity solution emerges as the first term in the asymptotic expansion. The analysis takes into account the finiteness of the base, eliminates the infinite velocity of slip at the base present in Chapmans solution, and predicts reverse flow in the dead-air region. Author (TAB)

N70-32093# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STRUCTURE OF A SHOCKWAVE IN A RADIATING GAS
B. G. Demina 1970 5 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat. Mekhan. i Astron. (Leningrad), no. 1, 1970 p 98 – 102
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Shocks of subcritical amplitudes in the range from 20,000 to 300,000 K are considered. The structure of a shock wave front in a radiating gas, which is mathematically the solution of a system with integrals of the hydrodynamics and radiation transport equations for the intensity of radiation and frequency, is determined with these assumptions: the gas is ideal, the shock is strong, and the radiation pressure and energy density are negligibly small as compared with the pressure and energy density of the material. It is concluded that the spectral dependence of the absorption coefficient substantially affects the distribution of hydrodynamic parameters by changing the exponent of the exponential. F.O.S.

N70-32110*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSPORT PROPERTIES OF HIGH TEMPERATURE GASES
Richard S. Brokaw *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 41 – 62 refs Presented at 3d Intern. Symp. on High Temp. Technol., Asilomar, Calif., 1967 (See N70-32106 17-33)
Avail: CFSTI CSCL 20D

Outlined is an adequate theoretical framework for predicting transport properties of high temperature gases and the differences from room temperature gases that arise as a consequence of phenomena not usually encountered at modest temperatures, for example, the presence of mobile chemical equilibria or the presence of atoms or free radicals which are valence unsaturated. Briefly discussed are transport properties of gases at moderate temperatures followed with a section on heat conduction in chemically reacting gas mixtures, and then a section on the effect of the "unusual" intermolecular forces between labile atoms and/or free radicals. The paper concludes with a discussion of some of the unique phenomena in ionized gases (plasmas). Author

N70-32111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL MEASUREMENTS OF DIFFUSION COEFFICIENTS FOR ATOMIC OXYGEN
Charles E. Baker *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 63–74 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 20D

The method for determining atom diffusion coefficients discussed uses recombination of the atoms of a partially dissociated gas on a catalytic surface placed in the gas flow. The essential features of the method are illustrated. A gas such as oxygen flows past the cavity of a microwave generator, and a few percent of the molecules are dissociated. The resulting mixture of atoms and molecules continues down the tube, flows past the catalytic probe, and then into high-speed pumps. The catalytic probe responds to the recombination of the atoms on its surface. An experiment of this type is capable of yielding information from which the diffusion coefficient of the atom through the background gas can be determined. Author

N70-32112*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSPORT PROPERTIES OF COMPLEX MIXTURES
Roger A. Svehla *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 75–88 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 20D

The problem of calculating the transport properties of gas mixtures is summarized. The calculation of complex mixtures requires a large quantity of input data including composition, transport data for the pure species, and transport data for the interactions between different species. Accumulating these data is the most difficult part; but with the aid of computers it is possible to handle even very complex mixtures. Author

N70-32115*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
KINETICS OF THE DISSOCIATION OF BROMINE
Marvin Wershay *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 119–132 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 20D

An investigation of the dissociation rates of Br2 in the presence of all five noble gases has been carried out. The experimental shock tube results were sufficiently precise to use as a basis for evaluating five recent theoretical dissociation-recombination models. The general conclusions are as follows: 1. all predictions of the absolute rate constants, except for the Keck-Carrier model, were within an order of magnitude of the experimental rate; 2. one common flaw which all five models had was predicting the wrong temperature coefficient of the activation energy; and 3. since the measured relative efficiencies of the five noble gases did not vary to a great extent, the model which predicted no variation, the Keck-Carrier model, came closest. Certainly diatomic collisions with inert atoms are not the whole story of dissociation-recombination. However, these results and the analysis made with them should aid the development of theoretical models and lead to a better understanding of dissociation and recombination. Author

N70-32244# Cincinnati Univ., Ohio. Dept. of Mechanical Engineering.
LAMINAR JET MIXING WITH INITIAL AND BOUNDARY EFFECTS
Y. G. Tsuei and E. W. Allis Apr. 1970 30 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-704983; THEMIS-70-9; AROD-T-4-15-E) Avail: CFSTI CSCL 20/4

The objectives of the report are to investigate the flow field and the wall shear stress for laminar tangential injection. The effects of the boundary and initial velocity profiles under zero pressure gradient are considered. A linearized approximation with a coefficient chosen from the parameters of the boundary layer was used to analyze the slot injection. It is found that wall shear stress is almost independent of the ratio of jet velocity to free stream velocity and the ratio of slot height to initial outside boundary layer thickness. It is also found that the effectiveness of the jet mixing is greater for large ratios of slot height to initial outside boundary layer thickness than for small ratios. The asymptotic solution of the velocity distribution far downstream is compared with the Blasius profile and good agreement is found. The results can be used for film cooling to estimate the spacing between the injection slots for effective protection. Author (TAB)

N70-32260*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODIFICATIONS TO FOURIER'S LAW OF HEAT CONDUCTION THROUGH THE USE OF A SIMPLE COLLISION MODEL
Willard E. Meador Washington Jul. 1970 38 p refs
(NASA-TN-D-5883; L-7018) Avail: CFSTI CSCL 20D

The exact first-order solution of an approximate kinetic equation is obtained for the problem of viscous gases flowing through circular pipes with constant temperature gradients. When expressed in terms of transport coefficients, the resulting flux-force relations are assumed to be correct since they agree in the proper limit with the Grad- 13-moment approximation. However, the complete flux-force relations have important contributions from at least the first 22 moments; in particular, terms of convection magnitude are added to both the axial and radial components of the 13-moment equations for thermal conduction. These terms, which are linearly proportional to the magnitude of the flow velocity (instead of the square), significantly alter the conventional Navier-Stokes description of heat transfer in the problem considered. They also affect the evaluation of the pressure tensor. Author

N70-32281*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESEARCH AND ADVANCED CONCEPTS
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 242–249 (See N70-32267 17-30)
Copyright. Avail: CFSTI

Investigations of blown arc deflection and MHD power conversion are reported. Transverse gas glow was found to influence an electric arc configuration with respect to its deflection, thickness, and location. Testing of the NaK-nitrogen conversion system was begun, and initial results indicate the louvre configuration is effective in the reduction of liquid loss. N.E.N.

N70-32285# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
ON SOLITARY INTERNAL WAVE MEASUREMENTS
R. P. Mied and J. P. Dugan [1969] 19 p refs
(Grant NSF GA-641x)
Avail: Issuing Activity

The experimental investigation of interfacial waves is discussed. The resolution required to measure small wave heights rendered photographs virtually useless; a new measurement technique was devised. The new probe and some interesting observations on internal solitary waves are examined. Author

N70-32305*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE INFLUENCE OF GAS VELOCITY ON THE BREAKDOWN POTENTIAL OF ARGON, HELIUM, AND NITROGEN
J. A. Gardner *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 177–182 (See N70-32286 17-09)
Avail: CFSTI CSCL 20D

An experimental investigation was performed to determine the influence of gas velocity and pressure on the electrical breakdown potential of argon, helium, and nitrogen between parallel plate electrodes and with concentric electrodes. Such information is useful for devices that depend on an electrical discharge such as an MHD or magnetoplasmadynamic arcs, and for evaluating characteristics of electrical components or equipment which might be exposed or immersed in a gaseous flow field. Author

N70-32310# Bureau of Mines, Amarillo, Tex. Helium Research Center.
COMPRESSIBILITY FACTORS FOR HELIUM AND CARBON DIOXIDE MIXTURES AT −10C and −20 C AND PRESSURES TO 1000 psia
G. W. Weems and A. R. Howard Jul. 1970 48 p refs
(BM-RI-7412) Avail: CFSTI

An investigation to determine the compressibility factors for helium and carbon dioxide mixtures at −10 and − 20 C and pressures to 1,000 psia is reported. A Burnett apparatus was used. Tables of compressibility factors and approximations of the virial coefficients are presented for 10 binary mixtures as well as for helium and carbon dioxide. The results follow the same trend as data previously reported. Author

N70-32320*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A FIXED GEOMETRY WIND TUNNEL MODEL OF AN AUXILIARY INLET EJECTOR WITH A CLAMSHELL FLOW DIVERTER FROM MACH 0 TO 1.2
Fred W. Steffen and Albert L. Johns Washington Jul. 1970 42 p refs
(NASA-TM-X-2037; E-5554) Avail: CFSTI

A wind tunnel model of an auxiliary inlet ejector with a clamshell flow diverter was evaluated over a range of Mach numbers from 0 to 1.2. Geometric variables included primary nozzle area, shape and position of the auxiliary inlet doors, and the position of the clamshell flow diverter. The efficiency obtained with the doors at a calculated equilibrium position was generally less than the efficiency obtained with the doors at some fixed position. Fixed double-hinge door configurations had higher subsonic-cruise efficiency than fixed single-hinge door configurations. At Mach 0.9, the optimum subsonic-cruise configuration gave an efficiency of 0.902. Author

N70-32329# Lockheed Missiles and Space Co., Palo Alto, Calif.
COMPUTATION OF THE THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER EQUATIONS BY THE INTEGRAL RELATIONS METHOD
V. A. Bashkin [1970] 11 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz. (USSR), v. 8, no. 6, 1968 p 1280–1290
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The integral relations method is applied to the numerical integration of the equations for a conical external flow. An estimate of the accuracy of computing the local friction drag and local heat flux coefficients, as well as the friction stress, secondary flow velocity, and total enthalpy profiles, is made in three examples. Author

N70-32330# Lockheed Missiles and Space Co., Palo Alto, Calif.
APPROXIMATE METHOD OF TAKING ACCOUNT OF THE INFLUENCE OF REALNESS OF THE GAS IN HYPERSONIC FLOW ABOUT SEGMENTAL BODIES
M. G. Lebedev et al 1969 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 2, 1969 p 107–111
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is presented for taking account of the influence of physico-chemical processes on the flow around segmental bodies. The assumption is made that the whole gas in the shock layer on the frontal surface of the streamlined body is in equilibrium. The equilibrium flow around the forward part of a blunt body has the following properties: The flow field depends on the free stream Mach number and the compression coefficient in the normal shock, and the value of the effective adiabatic index is practically invariant in the whole shock layer. Author

N70-32331*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
LAMINAR BOUNDARY LAYER IN THE PRESENCE OF SUCTION
L. F. Kozlov Washington NASA Jun. 1970 176 p refs Transl. into ENGLISH of the publ. "Laminarnyy Pogranichnyy Sloy pri Nalichii Otsasyvaniya" Kiev, Naukova Oumka Press, 1968 p 1–193
(Contract NASw-1692)
(NASA-TT-F-602) Avail CFSTI CSCL 20D

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N70-32332*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
DIFFERENTIAL PRANDTL EQUATIONS. INTEGRAL RELATIONSHIPS AND BOUNDARY CONDITIONS
In its Laminar Boundary Layer in the Presence of Suction Jun. 1970 p 1–25 refs (See N70-32331 17-12)
Avail: CFSTI CSCL 20D

The basic differential equations are derived for steady isothermal flow of a viscous incompressible fluid in the absence of mass forces. The boundary conditions are obtained which take into account the presence of suction of small amounts of fluid from the boundary layer throughout the permeable surface of a body. Integral relationships are derived for developing approximation methods of computing the boundary layer. Author

N70-32333*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
CERTAIN PRECISE SOLUTIONS OF THE PRANDTL EQUATION
In its Laminar Boundary Layer in the Presence of Suction Jun. 1970 p 26–61 refs (See N70-32331 17-12)
Avail: CFSTI CSCL 20D

Available precise solutions are discussed for equations of the laminar boundary layer in the presence of suction and the solutions are presented in the form of converging series or detailed tables obtained by computer calculation. The intensive suction of a laminar boundary layer is emphasized. Author

N70-32334*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
APPROXIMATE METHODS OF CALCULATION FOR A PLANE BOUNDARY LAYER
In its Laminar Boundary Layer in the Presence of Suction Jun. 1970 p 62–91 refs (See N70-32331 17-12)
Avail: CFSTI CSCL 20D

Either the integral impulse relationship or the integral relationships for impulses and energy together can be used for an approximate calculation of a laminar boundary layer with an arbitrary velocity distribution along the outer boundary of the layer. By varying an approximate one-parameter set called a shape factor, a variety of profile shapes necessary for an approximate description of the velocity distribution in the boundary layer is created. The known methods of approximate calculation of a plane boundary layer are characterized by an assumed set of velocity profiles in the boundary layer and by the choice of integral relationships. Author

N70-32335*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
A THREE-DIMENSIONAL BOUNDARY LAYER
In its Laminar Boundary Layer in the Presence of Suction Jun. 1970 p 92–112 refs (See N70-32331 17-12)
Avail: CFSTI CSCL 20D

The problem of a spatial boundary layer on a movable wing, on a body of revolution, and on prolate bodies of arbitrary shape is considered. Streamlining with the slip of a flat plate of infinite length in the presence of fluid suction from a laminar boundary layer by a uniform flow of viscous incompressible fluid is also examined. Author

N70-32336*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
A BOUNDARY LAYER WITH SLOT SUCTION
In its Laminar Boundary Layer in the Presence of Suction Jun. 1970 p 113–132 refs (See N70-32331 17-12)
Avail: CFSTI CSCL 20D

The methods for calculating a laminar boundary layer with suction of a fluid through lateral slots placed on the surface of the body are based on the assumption that suction does not change the pressure distribution on the outer boundary of the layer. One method employs a one-parameter profile set and the other uses geometric constructions. Author

N70-32337*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
OPTIMAL SUCTION OF A LAMINAR BOUNDARY LAYER
In its Laminar Boundary Layer in the Presence of Suction Jun. 1970 p 133–158 refs (See N70-32331 17-12)
Avail: CFSTI CSCL 20D

The basic problems of optimal suction of a laminar boundary layer are studied to reduce the resistance of bodies moving at high velocities. The problem is considered with respect to the theory of hydrodynamic stability and of conversion of the laminar boundary layer into a turbulent layer, taking into account the initial turbulence of the flow and the roughness of the body surface. Author

N70-32346# Technische Hogeschool, Eindhoven (Netherlands). Heat Transfer Section
AN EXPERIMENTAL DETERMINATION OF THE TURBULENT PRANDTL NUMBER IN A DEVELOPING TEMPERATURE BOUNDARY LAYER
Johannes Blom (Ph.D. Thesis) 12 May 1970 123 p refs
Avail: CFSTI

Heat transfer in a turbulent boundary layer was investigated in a wind tunnel with air flowing over a partially heated, aerodynamically smooth flat plate. Existing theories concerning the velocity field together with momentum transfer implied are discussed with emphasis on applications of large computers for solving the equations of motion. Existing theories concerning the temperature field and heat transfer based on a known solution of the velocity field are considered. The distributions of turbulent Prandtl number in the thermal boundary layer are given. Author

N70-32367# Tasmania Univ., Hobart (Australia).
FUNDAMENTAL ASPECTS OF CONVECTIVE EVAPORATION AND DRYING
P. E. Doe (Ph.D. Thesis)
Avail: CFSTI

Developed are the physical aspects and methods of measuring concentration gradients in a mass transfer boundary layer to increase the understanding of the mass transfer process as such. Analogies between mass and heat transfer are utilized to predict mass transfer coefficients in situations involving convective mass transfer. Emphasis is placed on the effects of mass transfer in laminar flow for which a theoretical model is formed and used to assess the validity of the various mass transfer by comparing measured velocity, temperature, and humidity profiles within the laminar boundary layer. Measurements of velocity and temperature are performed by hot wire anemometry and resistance thermometry, whereas efficient measurements of humidity are obtained by wet thermocouple psychrometer. G.G.

N70-32433# Naval Postgraduate School, Monterey, Calif.
ON NUMERICAL METHODS FOR THE TREATMENT OF HYDRODYNAMIC SHOCKS
William Randall Davis (M.S. Thesis) Jun. 1969 48 p refs
(AD-704782) Avail: CFSTI CSCL 20/4

Several numerical methods used in the calculation of hydrodynamic shocks were investigated. Particular attention was given to the artificial viscosity approach of Von Neumann and Richtmyer and its application to the PUFF numerical scheme. The particle model approach of Ludford, Polachek and Seeger, and the method of Lax were also considered. Author (TAB)

N70-32436# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
A TIME-DEPENDENT ANALYSIS FOR QUASI-ONE-DIMENSIONAL, VISCOUS, HEAT CONDUCTING COMPRESSIBLE LAVAL NOZZLE FLOWS
Gerald I. Benison and Ephraim L. Rubin Mar. 1970 23 p refs
(Contract Nonr-839(34))
(AD-704534; PIBAL-70-12) Avail: CFSTI CSCL 20/4

A technique is presented for the numerical solution of quasi-one-dimensional, viscous, heat conducting, compressible Lava nozzle flows. A time-dependent finite difference scheme is used to integrate the unsteady flow equations yielding second-order accurate steady-state solutions. Several features of the shock wave solution are shown and discussed. Author (TAB)

N70-32441# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISPERSION OF A PLANE LAYER OF GAS WITH GRADUAL ENERGY RELEASE
I. V. Nemchinov 17 Mar. 1970 23 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), v. 1, 1961 p 17–26
(AD-704768; FTD-MT-24-375-69) Avail: CFSTI CSCL 20/4

There is considered the nonadiabatic dispersion of a plane layer of gas of assigned mass M in a vacuum taking into account gradual energy release according to a given law. It is shown that with several initial profiles of distribution of parameters the variables are divided. Usual differential equations are solved for determination of the relationship of characteristic pressure, density and velocity

to time for initially resting cold gas. The asymptotic power law of change of parameters, establishing energy release with prolonged time in comparison with characteristic gas-dynamic for energy release constant in time pressure, density and velocity is found. There is determined the pulse, affecting a hard surface, limiting the layer of gas on one side during energy release and time of subsequent adiabatic or isothermal dispersion. Author (TAB)

N70-32450# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERALIZED SIMILAR SOLUTIONS OF BOUNDARY LAYER EQUATIONS
L. G. Loitsyanskii 30 Sep. 1969 10 p refs Transl. into ENGLISH from Rev. Roum. Sci. Tech., Ser. Mecan. Appl. (Romania), v. 13, no. 4, 1968 p 549–553
(AD-700414; FTD-HT-23-470-69) Avail: CFSTI CSCL 20/4

A new approach to the solution of laminar boundary layer equations is presented. This method consists in reducing the fundamental boundary layer equations to a universal form by transferring the parameters expressing the influence of the external conditions, characteristic of each particular problem, to the number of independent variables. The approach is based on the use of the similarity concept generalized in the sense described in the paper. A universal equation, nondependent on a given velocity distribution U(x) on the outer boundary of the boundary layer, is derived and integrated in one-parameter and two-parameter approximations by means of a BESM-2 computer. The generalized similar solutions of the type obtained may be obtained for three-dimensional laminar boundary layers in an incompressible fluid, flows of homogeneous gas, equilibrium dissociating gas flows in magnetohydrodynamic boundary layers in conducting fluid, and also for a turbulent boundary layer. Author (TAB)

N70-32468*# National Aeronautics and Space Administration, Washington, D.C.
STUDY ON THE STABILITY OF BOUNDARY LAYERS AND COMPRESSIBLE FLUIDS [BEITRAG ZUR STABILITAT FREIER GRENZSCHICHTEN IN KOMPRESSIBLEN MEDIEN]
Hans Gropengiesser Feb. 1970 114 p refs Transl. into ENGLISH from German report DLR-FB-69-25, 1969 123 p
(NASA-TT-F-12786; DLR-FB-69-25) Avail: CFSTI CSCL 20D

The stability of free boundary or shear layers observed in jet flows and in the wakes of blunt bodies was studied. The investigation of inviscid stability properties involved a laminar velocity profile which develops from a compressible vortex layer under the influence of fluid friction. The amplification and propagation of phase velocity of small-amplitude disturbances were studied as a function of disturbance frequency and angle of wave propagation at various Mach numbers and temperature ratios. The phase velocities of disturbances relative to flow can be less than or greater than the speed of sound. Accordingly, the disturbance is classified as subsonic or supersonic. It is found that a change in the character of the disturbance may involve the amplification of a second model. Author

N70-32512*# Scripta Technica, Inc., Washington, D.C.
CALCULATION OF THE MOTION OF A SHOCK WAVE AND FLOW PARAMETERS IN A SHOCK TUBE WITH A NONINSTANTANEOUSLY OPENING DIAPHRAGM [RASCHET DVIZHENIYA UDARNOY VOLNY I PARAMETROV POTOKA PRI NEMGNOVENNOM OTKRYTII DIAFRAGMY V UDARNOY TRUBE]
Zh. S. Duntsova et al NASA Jul. 1970 13 p refs Transl. into ENGLISH from Izv. Adak. Nauk SSSR. Mekh. Zhidk. Gaza (USSR), no. 2, Mar-Apr. 1969 p 102–128
(Contract NASw-2036)
(NASA-TT-F-12602) Avail: CFSTI CSCL 20D

Calculation of changes in the shock wave velocity and gas-flow parameters in the process of noninstantaneous opening of diaphragm of a shock tube. The method of characteristics is used in developing the computer algorithms applied in the calculations. The calculated values for shock wave velocities and gas-flow parameters are compared with experimental results for a number of steel, aluminum, and brass diaphragms of various designs. Author

N70-32570# Advisory Group for Aerospace Research and Development, Paris (France).
NUMERICAL METHODS FOR VISCOUS FLOWS. Abstracts of Seminar Papers
R. C. Lock, ed. [1970] 89 p refs
(AGARD-CP-60) Avail: CFSTI

Abstracts of seminar papers are presented dealing with: (1) solutions of the Navier-Stokes equations; (2) numerical methods for turbulent boundary layers; and (3) solutions of the higher order boundary layer problems. Author

N70-32589*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIELECTROPHORETIC BAFFLING TO CONTROL VAPOR INGESTION IN WEIGHTLESSNESS
Roland J. Raco (Newark Coll. of Engineering), Steven G. Berenyi, and Donald A. Petrash Washington Jul. 1970 26 p refs
(NASA-TM-X-2040; E-5604) Avail: CFSTI CSCL 20D

An experimental program was conducted in the Lewis Research Center's 2.2-Second Zero Gravity Facility to observe the effect of dielectrophoretic baffling on the vapor ingestion phenomenon. The study was conducted with flat-bottom right-circular cylindrical tanks in both normal gravity and weightlessness. Dielectrophoretic baffling had an insignificant effect on the vapor ingestion phenomenon in normal gravity. In weightlessness, the minimum liquid height with dielectrophoretic baffling was always smaller than the critical height without dielectrophoretic baffling. The use of dielectrophoretic baffling in weightlessness also increased the amount of liquid expelled before vapor ingestion. Effects of the electric fields associated with various electrode configurations are also discussed. Author

N70-32662# Naval Postgraduate School, Monterey, Calif.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF TURBULENT JET INTERACTION
Steven Brian Weeks (M.S. Thesis) Oct. 1969 98 p refs Sponsored by AROD
(AD-704086) Avail: CFSTI CSCL 20/4

The interaction of two impinging plane turbulent jets was investigated for the purpose of understanding the performance of proportional fluid amplifiers and momentum-exchange devices. Velocity and turbulence profiles were measured across and at various distances along the combined jet axis through the use of a constant temperature hot-wire anemometer. Experimentally determined jet deflection angles were found to agree with those predicted in a previous work by the free-streamline theory. The results, which are presented in terms of normalized parameters, show that the jet interaction may be divided into three regions: mixing; transition; and fully developed. A vena-contracta effect was found to exist in the mixing region. A discussion of each of the three regions is presented in detail along with generalizations for similar geometries. Author (TAB)

N70-32668# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VELOCITY AND TEMPERATURE DISTRIBUTION IN A SYSTEM OF PLANE JETS
M. A. Izyumov et al 10 Mar. 1970 26 p refs Transl. into

ENGLISH from Teoriya i Prakt. Szhiganiya Gaza, Naucho-Tekhn. Obshchestvo Energ. Prom. (USSR), v. 4, 1968 p 25–39
(AD-704845; FTD-MT-24-393-69) Avail: CFSTI CSCL 20/4

A study is made of a system of several jets issuing from plane nozzles. The experimental study included the determination of the total dynamic and static pressures and the temperature fields at different cross-sections of the jet system. A comparison of the experimental and calculated results showed a close correlation of the findings. Author (TAB)

N70-32725# California Univ., Berkeley. Lawrence Radiation Lab.
INFLUENCE OF SURFACE TURBULENCE AND SURFACTANTS ON GAS TRANSPORT THROUGH LIQUID INTERFACES
Thomas G. Springer (Ph.D. Thesis) and Robert L. Pigford 1969 140 p refs
(Contract W-7405-eng-48)
(UCRL-18995) Avail: CFSTI

An apparatus called an interface impedance bridge is described for the observation of the resistance to passage of a soluble gas through a gas-liquid interface under dynamic conditions. The apparatus resembles an electrical a.c. bridge circuit and permits measurements to be made over a range of frequencies. The interface impedance bridge is used to measure passage of a soluble gas through a gas-liquid interface under varying conditions. Measurements over a range of frequencies of gas pressure oscillations allowed tests of interface mass transfer mechanisms, including the effects of soluble and insoluble surfactants on both stagnant and turbulent liquid surfaces. Analysis of the turbulent interface of a clean liquid shows that a Danckwerts type distribution function of surface ages may be used to describe the statistical characteristics of the interface under the conditions of these experiments. Author (NSA)

N70-32784# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE MOTION OF A DISLOCATION, ACTED ON BY A VISCOUS DRAG, THROUGH AN ARRAY OF DISCRETE OBSTACLES Interim Technical Report
H. J. Frost and M. F. Ashby Mar. 1970 26 p refs
(Contracts N00014-67-A-0298-0020; ARPA SD-88)
(AD-704520; TR-1) Avail: CFSTI CSCL 20/11

A computer model was used to calculate the shape and average velocity of a dislocation acted on by a viscous drag, and moving through a field of point obstacles. As a special case, the operation of a Frank-Read source was computed also. At sufficiently low velocities (and stress levels) the behavior is governed entirely by the obstacle spacing and strength; conventional tensile probably falls in this regime. At sufficiently high velocities (and stress levels) the behavior is governed entirely by the viscous drag; explosive deformation falls in this regime. In between lies a wide range in which the two effects superimpose, each contributing measurably to the flow stress. Author (TAB)

N70-32796*# National Aeronautics and Space Administration, Washington, D.C.
SOME PATTERNS OF THE PULSATING MOTION OF A SOLID PARTICLE IN TURBULENT FLOW [NEKOTORYYE ZAKONOMERNOSTI PULSATSIONNOGO DVIZHENIYA TVERDOY CHASTITSY V TURBULENTNOM POTOKE]
Z. R. Gorbis et al Jul. 1970 10 p refs Transl. into ENGLISH from Iz. Akad. Nauk SSSR, Mekh. Zhik. i Gaza (USSR), no. 1, 1969 p 137–141
(NASA-TT-F-12605) Avail: CFSTI CSCL 20D

The transverse pulsations of a spherical particle in turbulent flow are presented. The effect of a number of factors on the intensity of pulsations in the velocity of the solid component in continuous dispersion flows are estimated. Equations of motion and mathematical relationships are determined. Author

N70-32816# McDonnell-Douglas Co., St. Louis, Mo. Aircraft Div.
A FINITE-DIFFERENCE METHOD FOR CALCULATING COMPRESSIBLE LAMINAR AND TURBULENT BOUNDARY LAYERS, PART 1
Tuncer Cebeci, A. M. O. Smith, and L. C. Wang Mar. 1969 97 p refs
(DAC-67131) Avail: CFSTI

A finite difference method is presented for solving laminar and turbulent boundary layer equations for incompressible and compressible flows about two dimensional and axisymmetric bodies and contains a thorough evaluation of its accuracy and computation time characteristics. The Reynolds shear-stress term is eliminated by an eddy viscosity concept, and the time of mean of the product of fluctuating velocity and temperature appearing in the energy equation is eliminated by an eddy conductivity concept. The turbulent boundary layer is regarded as a composite layer consisting of inner and outer regions, for which separate expressions for eddy viscosity are used. The eddy conductivity term is lumped into a turbulent Prandtl number that is assumed to be constant. The method was programed on the IBM 360/65, and its accuracy was investigated for a large number of flows by comparing the computed solutions with the solutions obtained by analytical methods, as well as with solutions obtained by other numerical methods. On the basis of these comparisons, it can be said that the present method is quite accurate and satisfactory for both laminar and turbulent flows. Author

N70-32819*# Techtran Corp., Glen Burnie, Md.
LINEAR THEORY OF UNSTEADY GAS MOTION UNDER THE ACTION OF NON-POTENTIAL EXTERNAL FORCES [K LINEYNOY TEORII NESTATSIONARNOGO DVIZHENIYA GAZA POD DEYSTVIEM NEPOTENTSIALNYKH VNESHNIKH SIL]
V. E. Baskin Washington NASA Jul. 1970 15 p refs Transl. into ENGLISH from Iz. Akad. Nauk SSSR, Mekhan. Zhid. i Gaza (USSR), p. 58–65
(Contract NASw-2037)
(NASA-TT-F-13052) Avail: CFSTI CSCL 20D

Study of the velocity and pressure fields produced in a compressible medium by the arbitrary motion of deformable load carrying filament. Explicit general formulas are derived to determine the velocity fields at given points of such a medium as a function of free vortices moving into acoustic-signal audibility zones around these points. The vortices are a result of the motion of the filament which penetrates a curvilinear surface in the medium. The study is designed to reconstruct, in a linear representation, the situations arising during unsteady gas motion past a slender body in the presence of nonpotential external forces. Author

N70-32828*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
HEAT-TRANSFER MEASUREMENTS AT MACH 8 ON A FLAT PLATE WITH DEFLECTED TRAILING-EDGE FLAP WITH EFFECTS OF TRANSITION INCLUDED
Charles B. Johnson Washington Jul. 1970 54 p refs
(NASA-TN-D-5899; L-6349) Avail: CFSTI CSCL 20D

An experimental heat transfer investigation was made on a flat plate model with a short trailing edge flap deflected at angles of 10, 20, and 30 deg, relative to the plate surface. The tests were conducted at a nominal free stream Mach number of 8, and the nominal free stream unit Reynolds number was varied from 0.72 to 35.8 million per meter. The heat transfer and schlieren results indicated that transition first occurred for the largest flap angle in the separated region at a unit Reynolds number approximately an order of magnitude lower than that for an undisturbed flat plate. Various theories for laminar flow are applied for separated-and attached-flow conditions, and various theories for turbulent flow are

applied to the flow over the flap. The heating near flow reattachment on the flap for transitional separation was as much as two times greater than the theoretical prediction for turbulent flow. Author

N70-32840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER IN A 60 DEG HALF-ANGLE OF CONVERGENCE NOZZLE WITH VARIOUS DEGREES OF ROUGHNESS
Donald R. Boldman and Robert C. Ehlers Washington Jul. 1970 31 p refs
(NASA-TN-D-5887; E-5597) Avail: CFSTI CSCL 20M

An experimental heat transfer study was conducted in a converging-diverging nozzle having various values of wall roughness. The working fluid was air, which was heated to a stagnation temperature of 970 R (538 K). The stagnation pressure was varied from 30 to 300 psia. The nozzle was roughened by a sandblasting technique to three levels of roughness: 120, 175, and 325 rms. Both a cooled and an adiabatic inlet, each having smooth walls, were used to determine the effects of the thermal history of the fluid on the nozzle heat transfer. Author

N70-32924*# Alabama Univ., Huntsville. Bureau of Engineering Research.
TWO PHASE FLOW AND HEAT TRANSFER IN POROUS BEDS UNDER VARIABLE BODY FORCES, PART 5 Final Report
James V. French, Jr. and Harold R. Henry Dec. 1969 88 p refs
(Contract NAS8-21143)
(NASA-CR-102788; Rept-113-30-Pt-5) Avail: CFSTI CSCL 20D

The feasibility of using two dissimilar porous cartridges in series with appropriate instrumentation to constitute a two-phase mass flowmeter is investigated. Results indicate that the meter can be calibrated for a particular gas and liquid by a series of runs in which the flow rates of the gas and liquid are separately metered. The pressure drop across each cartridge is measured and the temperature and absolute pressure in the space between cartridges is recorded. A calibration chart is constructed with the pressure drop across one cartridge plotted against the pressure drop across the other, for constant values of liquid flow rate, and the constant gas mass flow rate is superimposed. Author

N70-32933*# Techtran Corp., Glen Burnie, Md.
MEASUREMENT OF GAS DENSITY IN A SUPERSONIC RAREFIED FLOW BY MEANS OF GLOW-DISCHARGE LUMINESCENCE [OB IZMERENII PLOTNOSTI GAZA V SVERKHZVUKOVOM RAZREZHENNOM POTOKE PRI POMOSHCHI SVECHENIYA TLEYUSHCHEGO RAZRYADA]
V. N. Kalugin Washington NASA Jul. 1970 10 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, 1969 p 106–109
(Contract NASw-2037)
(NASA-TT-F-13010) Avail: CFSTI CSCL 20D

The relationship was found between gas density in supersonic rarefied flow and negative luminescence in a glow-discharge. Some results are given of density measurement in a free stream and in a model. It is shown that density measurement of negative luminescence of a glow-discharge is effective in static pressure range of 5 times 0.01 to 5 times 0.0001 mm mercury. Author

N70-32940# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.
BASIC STUDIES IN GAS-SOLID SUSPENSION Final Report
Richard L. Peskin Feb. 1970 72 p refs
(Contract AT(30-1)-2930)
(NYO-2930-15) Avail: CFSTI

A theoretical and experimental study of turbulent gas-solid flow is reported. Topics in gas-solid heat transfer and momentum transfer are considered and a new nondimensional group which considers effects of particle separation and boundary layer penetration is presented. Mechanisms controlling particle motion in turbulent flow are discussed, together with the effects of particle motion on the gas turbulence. Gas-solid shear flow is considered and the importance of particle Reynolds stress emphasized. Thermal forces in gas-solid slip flow are computed and certain classical paradoxes discussed. Areas of application and problems for future research are included in the report. Author (NSA)

N70-32957# RAND Corp., Santa Monica, Calif.
A GENERAL PROGRAM FOR RADIATION AND HYDRODYNAMIC FLOW IN ONE DIMENSION
Harold L. Brode Mar. 1970 10 p refs Presented at the 2d Intern. Colloq. Gasdyn. of Explosion and Reacting Systems, Novosibirsk, USSR, Aug. 1969 Submitted for publication
(AD-703566; P-4335) Avail: CFSTI CSCL 20/4

A numerical program is described which represents hydrodynamic and radiation flow in one space dimension. The effects of heat conduction and chemical reactions (burning or detonation) can be included. A variety of useful boundary conditions is provided. It was applied to a number of physically interesting problems. Author (TAB)

N70-32968*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF CLOSE-RANGE ROCKET EXHAUST IMPINGEMENT ON SURFACES IN A VACUUM
Leonard V. Clark Washington Jul. 1970 30 p refs
(NASA-TN-D-5895; L-6089) Avail: CFSTI CSCL 20D

An experimental ground-based program was conducted to investigate the effects of rocket-exhaust impingement on close-range surfaces. Although the configuration used in this investigation simulated the Apollo lunar module during lunar landing, the results are considered to be generally applicable to similar programs. A 1/10.5-scale model of the lunar module retrorocket with its base structure was fired at flat, dished, and particulate surfaces under near-vacuum conditions. Target-surface impingement pressures and heating rates, descent-stage base pressures, and nozzle static pressures were measured with the test rocket at various attitudes to the surface, altitudes above the surface, and operating thrust levels. Author

N70-32984# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SONIC FLOW OF AN IDEAL GAS PAST HALF-BODIES
Yu. B. Lifshits et al 19 Mar. 1970 19 p refs Transl. into ENGLISH from Zh. Vychisl. Mat. i Mat. Fiz. (USSR), v. 9, no. 2, 1969 p 387–396
(AD-705165; FTD-HT-23-91-70) Avail: CFSTI CSCL 20/4

Procedures are derived for solving the problem of a transonic gas flow past semi-infinite bodies consistent with a given inequality. The unknown flow potentials are found by these procedures as the sum of two terms: one representing the perturbations produced by a finite body and the other having a higher order of smallness. The latter term represents the boundary conditions at the surface of a semi-infinite body. A formula is derived for determining the multiplicative constant contained in the first term of the perturbation potential of an axisymmetrical flow. Author (TAB)

N70-33068*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EXPERIMENTAL WINDAGE LOSSES FOR CLOSE CLEARANCE ROTATING CYLINDERS IN THE TURBULENT FLOW REGIME

Sol H. Gorland, Erwin E. Kempke, Jr., and Stacey Lumannick Jun. 1970 21 p refs
(NASA-TM-X-52851; E-5786) Avail: CFSTI CSCL 20D

Viscous torque (windage) of a 12-inch diameter, 5.9-inch long cylinder rotating within a stationary concentric housing was measured at speeds up to 24,000 rpm. Three housings were mounted on a reaction torque measuring device which eliminated any disc type end effects. Reynolds numbers (Re) in excess of 100,000 were produced using the gap thickness as the characteristic dimension. It was found that above a Re of 15,000 the curves of drag coefficient vs Re for all three gaps coincided within five percent. Author

N70-33079# Battelle-Northwest, Richland, Wash.
COMPRESSIBLE FLUID FLOW: BNW PROGRAM GAS
Bernard H. Duane 18 Sep. 1969 75 p refs
(Contract AT(45-1)-1830)
(BNWL-1317) Avail: CFSTI

Battelle-Northwest Program, GAS is used to construct analytic streamtube integrals for the supersonic or subsonic flow of a real gas (having temperature-variant specific heats) through an open-loop or closed-loop succession of nozzles, oblique-shock diffusers, normal shocks, bypass flows with pressure-matched reentries, heat exchangers, burners, turbines, compressors, shock pumps, and other such elements simply characterizable in terms of mass, energy, momentum, or entropy transfer. Analysis versatility includes coupled variation of design specifications to meet performance requirements. Author (NSA)

N70-33097# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECT OF CONDENSATION IN THE BOUNDARY LAYER ON MASS TRANSFER FROM A ROTATING DISK
Ronald P. Omberg (Ph.D. Thesis) Oct. 1969 180 p refs
(Contract W-7405-eng-48)
(UCRL-18577) Avail: CFSTI

This phenomenon was analyzed by combining the microscopic balance equations of nucleation kinetics with the boundary layer conservation equations. The equations were derived for rotating disk hydrodynamics and calculations made for the vaporization of iron into cold argon. The vaporization rate of the roating disk was computed, and the structure of the nucleation zone in the boundary layer surrounding the disk was examined. The vaporization rate was measured experimentally for a hot rotating disk of chromium vaporizing into a cold helium environment. The data showed that condensation enhancement of the vaporization rate does occur. The vaporization rate proceeded, within the error bounds of the measurement, from the condensation-free value to the bulk equilibrium condensation value as the temperature was increased. The measured rates were compared with the theoretical rates calculated. It is felt that better agreement between experiment and theory could be obtained with a nucleation kinetic model which gives a larger nucleation rate for a given supersaturation. Author (NSA)

N70-33117# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Fluid Mechanics Section.
KINETIC THEORY OF TURBULENT FLOW
James T. Yen Jul. 1970 62 p refs Presented at the Am. Phys. Soc. Ann. Meeting, Norman, Okla., Nov. 1969
(RE-385J) Avail: CFSTI

An analytical approach is proposed for resolving the closure problem and for achieving the analytical treatment of turbulent flow. The new approach uses the kinetic theory and a new approximation of the particle velocity distribution function in the time-average-flow-velocity frame. In that frame, a small deviation from the Maxwellian is sufficient to produce strong turbulence since the turbulent Mach number is a natural small parameter even for strong turbulence. Author

N70-33120# Lockheed Missiles and Space Co., Palo Alto, Calif.
NUMERICAL SOLUTION OF SOME GAS DYNAMICS PROBLEMS
V. N. Fomin et al [1970] 16 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz. (USSR), v. 10, no. 2, 1970 p 401–416
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results from the investigation of low supersonic gas flow around blunt bodies are described. Emphasis is placed on the determination of blunt body characteristics in the presence of viscosity, physicochemical transformations, and radiation. Four types of problems are considered: perfect supersonic gas flow around an axisymmetric cylindrical endface and sphere; flow around blunt bodies at low supersonic velocities; hypersonic viscous perfect gas flow around blunt bodies for low values of the Reynolds number; and supersonic flow of an equilibrium dissociating and ionizing gas around blunt bodies taking account of selective radiation and absorption. Only fundamental ideas of constructing the appropriate schemes are presented in describing the numerical methods. Author

N70-33135# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
ON THE CONNECTION BETWEEN ELEMENTARY COLLECTIVE COORDINATES AND THE VLASOV EQUATION
Jerome K. Percus and George J. Yevick 1 Mar. 1970 20 p refs *Its* Spec. Rept. No. 1
(Contract AT(30-1)-2582; Proj. Chalice)
(SIT-2582-32; SIT-246) Avail: CFSTI

A naive collective coordinate analysis leads to no damping of the acoustic modes of a classical fluid. A similar analysis of the linearized Vlasov equation leads to the well known phenomenon of Landau damping. The qualitative form of Landau damping is, however, inaccurate for nonsingular forces and probably for low-k propagation in plasmas. Comparison of the two approaches shows that retention of the velocity variable in the Vlasov equation allows for an accurate description of positional fluctuations due to velocity dispersion by itself, but a poor assessment of collective forces. If, instead, the phase mixing of collective modes due to velocity dispersion is taken into account, a damping mechanism is introduced with the anticipated hydrodynamic form in fluids at low k, and with a k to the 4th power dependence for plasmas. Author (NSA)

N70-33154*# TRW Systems, Redondo Beach, Calif.
A STUDY TO ANALYZE THE PERMEATION OF HIGH DENSITY GASES AND PROPELLANT VAPORS THROUGH SINGLE LAYER TEFLON OR TEFLON STRUCTURE MATERIALS AND LAMINATIONS Final Design Guide, 5 Jul. 1966 – 28 Jul. 1969
R. L. Johnson 15 Aug. 1969 101 p refs
(Contract NAS7-505)
(NASA-CR-109768; TRW-07282-6033-R0-00) Avail: CFSTI CSCL 20D

Diffusion flow rate results are presented for laminated bladders of a type which could find application with positive liquid expulsion systems to be used on long term space missions. Leakage through barrier holes may be estimated from the results calculated for single round holes and slits. Instructions are given for the application of the flow rate data to contamination predictions. The limitations on the use of the analysis and the experimental data are reviewed. It is shown that the minimum time required for the pressurant gas to contaminate the fuel to a specific level can be calculated with prior knowledge of bladder structure parameters. Also, the maximum allowable number of barrier holes of a given size, or distribution of sizes, can be estimated for a specified flight time and allowable contamination level. Operating instructions for the diffusion analysis program are included. This computer program may be used for flow

rate predictions of a chemical component diffusing through a bladder of known composition and for predicting the growth rate of gas bubbles on the bladder surface. Author

N70-33201*# Techtran Corp., Glen Burnie, Md.
ENTROPY SCHEME FOR GAS DYNAMICS CALCULATION [OB ENTROPIYNOY SKHEME RASCHETA GAZODINAMIKI]
V. Ya. Goldin et al. Washington NASA Jul. 1970 6 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz. (Moscow), v. 9, no. 6, 1969 p 1411–1413
(Contract NASw-2037)
(NASA-TT-F-13018) Avail: CFSTI CSCL 20D

A difference scheme is constructed for calculations in one-dimensional gas dynamics with thermal conductivity, in which the approximated viscosity does not lead explicitly to an entropy gain. Author

N70-33203*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF A DIRECTIONAL-MEAN-FREE-PATH METHOD FOR GAS FLOW IN TRANSLATIONAL NONEQUILIBRIUM
E. Dale Martin Washington Jul. 1970 168 p refs
(NASA-TN-D-5762) Avail: CFSTI CSCL 20D

The development and possible utility of a directional level of description is considered. Properties and equations on the directional level are obtained by integrating the molecular properties and the Boltzmann equation over all magnitudes of molecular velocity. The resulting dependent variables (properties of a class of molecules) then depend on space, time, and molecular-velocity direction, but not magnitude. Use of the directional-mean-free-path approximation leaves the equations on the directional level in a form where use of Lagrange's expansion for further approximation appears natural. For more than one independent variable, generalizations of Lagrange's expansion are needed, and simple forms that are directly applicable are derived. A perturbation-expansion scheme based on these generalizations is also developed. This scheme is then applied to the equations in the directional-mean-free-path method, to simplify the theory. The use of the directional-mean-free-path method is illustrated by an outlined application to the problem of steady-flow shock-wave structure in a monatomic gas. Author

N70-33224*# Techtran Corp., Glen Burnie, Md.
VISCOUS LIQUID FLOW IN THE INITIAL SEGMENT OF A FLAT CHANNEL WITH POROUS WALLS [TECHENIYE VYAZKOY ZHIDKOSTI V NACHALNOM UCHASTKE PLOSKOGO KANALA S PORISTYMI STENKAMI]
V. N. Varapayev Washington NASA Feb. 1970 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, Jul.–Aug. 1969 p 178–181
(Contract NASw-1695)
(NASA-TT-F-12803) Avail: CFSTI CSCL 20D

The nature of the flow in the initial segment of a flat channel with a permeable and impermeable bottom is defined. The investigation is conducted by means of a numerical solution of the Navier–Stokes equations by the finite difference method. Author

N70-33225*# Techtran Corp., Glen Burnie, Md.
NATURAL OSCILLATIONS OF A GAS FLOWING ABOUT A LATTICE OF PLATES [O SOBSTVENNYKH KOLEBANIYAKH GAZA, OBTEKAYUSHCHEGO RESHETKU PLASTIN]
V. B. Kurzin Washington NASA Jun. 1970 15 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 5, 1969 p 68–75
(Contract NASw-2037)
(NASA-TT-F-13014) Avail: CFSTI CSCL 20D

Oscillations of a gas flow around a lattice of plates were studied with the application of the contraction method for solution. Also considered were natural oscillations of gas in an infinite plane, channelling them annularly, given the condition of spatial periodicity of flow. Author

N70-33227*# Translation Consultants, Ltd., Arlington, Va.
STABILITY OF THE LAMINAR BOUNDARY LAYER OVER A DEFORMABLE DIAPHRAGM TYPE SURFACE [USTOYCHIVOST LAMINARNOGO POGRANICHNOGO SLOYA NA DEFORMIRUYEMOY POVERKHNOSTI MEMBRANNOGO TIPA]
V. V. Skripachev Washington NASA Jun. 1970 10 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 6, 1969 p 52–56
(Contract NASw-2038)
(NASA-TT-F-12969) Avail: CFSTI CSCL 20D

The stability of the Blasius flow over a diaphragm-type surface, the physical characteristics of which are constant along the length, is examined. Author

N70-33228*# Translation Consultants, Ltd., Arlington, Va.
THE STRUCTURE OF LOW-DENSITY SUPERSONIC JETS [STRUKTURA SVERKHZVUKOVOY STRUI NIZKOY PLOTNOSTI]
V. I. Nemchenko Washington NASA Jun. 1970 13 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 6, 1969 p 110–115
(Contract NASw-2038)
(NASA-TT-F-12968) Avail: CFSTI CSCL 20D

The results of an experimental investigation conducted in a low density wind tunnel, to determine the structure of a supersonic jet for different discharge conditions are given. Procedures used to obtain the results are described, and the effect of the Mach number, and of flow rarefaction, on the formation of the flow in the normal shock wave region are discussed. Author

N70-33235# Lockheed Missiles and Space Co., Palo Alto, Calif.
TWO-DIMENSIONAL PROBLEM OF PLANE WAVE PROPAGATION IN A TWO-COMPONENT ANISOTROPIC MEDIUM
Ia. U. Saatov et al. [1970] 2 p refs Transl. into ENGLISH from Rasprostranenie Uprugikh i Uprugoplasticheskikh Voln (Uz. SSR), 1969 p 310–313
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

Problems of the kind that arise in a study of plane wave propagation in water-saturated elastic ground, in mine-layered media, etc. are considered. A solution is presented involving the equations of motion for the liquid and solid components of the media. Formulation of the problem and system of equations is given. D.L.G.

N70-33239# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHOCK FRONT STRUCTURE IN A TWO-VELOCITY AND TWO-TEMPERATURE CONTINUUM WITH PARTICLES
R. I. Nigmatulin [1970] 9 p refs Transl. into ENGLISH from Rasprostranenie Uprugikh i Uprugoplasticheskikh Voln (Uz. SSR), 1969 p 229–240
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

One-dimensional stationary shocks in a two-phase medium consisting of a gas and particles of matter in solid or liquid state are examined, where the particle content in the medium is such that it is impossible to neglect their volume; such shocks being significantly thick. Recommendations are given on how to determine the friction law between phases experimentally. A weak influence

of heat exchange between phases on the pressure and velocity of the phases is detected in computations. Equations are derived for the equilibrium parameters behind the shock front. It is seen from these equations that shocks being propagated at a velocity less than the speed of sound in the gas are possible in two-phase media. Such waves do not have a discontinuity ahead of them and are completely spread out. Author

N70-33240# Lockheed Missiles and Space Co., Palo Alto, Calif.
SUBSONIC AND TRANSONIC VISCOUS GAS FLOW IN THE WAKE OF A FLAT BODY
V. I. Myshenkov [1970] 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 2, 1970 p 73–79
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of gas flow in the wake behind a finite thickness plate at subsonic and transonic flow velocities is considered within the scope of the Navier–Stokes equations. The problem is solved by the build-up method by using an explicit two-step difference scheme. The results of the computations agree qualitatively with existing theoretical and experimental results. Author

N70-33289*# Techtran Corp., Glen Burnie, Md.
NUMERICAL METHOD FOR SOLVING NON-STATIONARY AXISYMMETRIC PROBLEMS OF HYDRODYNAMICS OF AN IDEAL FLUID WITH FREE SURFACES [CHISLENNYY METAL RESHENIYA NESTATSIONARNYKH OSESIMMETRICHNYKH ZADACHI GIDROTLINAMIKI IDEALNOY ZHIDKOSTI SO SVOBODNYMI POVERKHMOSTYAMI]
G. A. Konstantinov et al Washington NASA Feb. 1970 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, Jul.–Aug. 1969 p 162 and 165
(Contract NASw-1695)
(NASA-TT-F-12801) Avail: CFSTI CSCL 20D

A method is proposed for the solution of problems concerning non-stationary axisymmetric potential flow of an ideal incompressible fluid with a free surface. The method is based on the discrete distribution of annular sources on boundary surfaces, which involves the reduction of the problem in question to a system of ordinary differential equations. Author

N70-33297*# Techtran Corp., Glen Burnie, Md.
CALCULATION OF TURBULENT FLOW CHARACTERISTICS IN A CHANNEL WITH AN INTERNAL ROTATING CYLINDER [K RASCHETU TURBULENTNYKH KHARAKTERISTIK TECHENIYA V KANALE S VNUTRENNIM VRASHCHAYUSHCHIMSYA TSILIDROM]
B. P. Ustimenko Washington NASA Jun. 1970 12 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), No. 3, 1969 p 121–127
(Contract NASw-2037)
(NASA-TT-F-13008) Avail: CFSTI CSCL 20D

A theoretical analysis of the turbulent characteristics of circular flow in a channel with an internal rotating cylinder is presented, based on the use of balance equations for pulsating energy for various directions of motion (whole and individual velocity components), along with the ordinary equations of average motion. Examination of the supplementary equation leads to information particularly on the distribution not only of average characteristics in the flow, but of pulsating ones as well. The results of the calculation are compared with experimental distributions of average velocity, pulse intensity, correlation, etc. Author

N70-33298*# Techtran Corp., Glen Burnie, Md.
ONE DIRECT DIAGRAM OF A METHOD OF CHARACTERISTICS FOR THE CALCULATION OF A THREE DIMENSIONAL GAS FLOW [OB ODNOY PRYAMOY SKHEME METODA KHARAKTERISTIK DLYA RASCHETA PROSTRANSTVENNYKH TECHENIY GAZA]
Ye. I. Grigoryev et al Washington NASA Jul. 1970 10 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz. (Moscow), v. 9, no. 6, 1969 p 1413–1419
(Contract NASw-2037)
(NASA-TT-F-13019) Avail: CFSTI CSCL 20D

In the method proposed characteristic surfaces are constructed and in place of trigonometric representation of parameters by one variable, a finite differential approximation along a certain vector lying in the characteristic surface is used. Derived information is ordered according to one of the variables distributed along meridional planes, using a cylindrical system of coordinates. In comparison with data of other methods using the results of calculation of supersonic flow on a spherically truncated cone at an angle by initial data on the characteristic surface shows that the new method more accurately reflects the prevalent physical particulars. It can also be adopted to extrapolate calculation from the initial data or to obtain the initial data for other methods on non-characteristic surfaces, and provides a precise physical flow picture. Author

N70-33305* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYDROFOIL Patent
Virgil E. Johnson, Jr. inventor (to NASA) Issued 16 Jan. 1962 (Filed 30 Mar. 1960) 3 p Cl. 114-66.5
(NASA-Case-XLA-00229; US-Patent-3,016,863; US-Patent-Appl-SN-18780) Avail: US Patent Office CSCL 13J

An improved hydrofoil with an efficient operation at high speeds and with sufficient structural strength to resist deformation during operation is described. A good lift drag ratio for high speed operation is also provided by this experimental design. J.A.M.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-32032# Department of Energy, Mines and Resources, Ottawa (Ontario).
GRAVITY SURVEYS IN THE ALEXANDRIA AREA, EASTERN ONTARIO
L. W. Sobczak 1970 38 p refs *Its* Publ. of the Dominion Obs., v. 39, no. 6
Avail: CFSTI

The results of gravity observations are presented in the form of a Bouguer anomaly map. The anomalies are correlated with magnetic and geological information and the interpretation of the gravity data is based on rock density measurements. Maps showing the computed first and second vertical derivatives of gravity are also presented. Negative Bouguer anomalies are correlated with the Chatham-Grenville syenite stock and a similar intrusion at Mount Rigaud on the southern border of the Grenville-A subprovince. It is postulated that the negative anomaly near Plaisance indicates the presence of a similar intrusion below the Paleozoic cover. The Alexandria High, a positive residual Bouguer anomaly which extends from Lunenburg to Pointe-au-Chene, may be explained by the presence of a basic lenticular body of thickness varying from 6000 to 9000 feet and width of 50,000 feet at a depth varying from 3000 to 5000 feet. The approximate thickness of the Grenville Series is 11,000 to 12,000 feet along the crest of the Alexandria High. The regional gravity gradient which increases from −30 mgal in the northwest to +10 mgal in the southeast of the area is correlated with a rise of over 10,000 feet of the Mohorovicic discontinuity. Author

N70-32074# General Dynamics/Convair, San Diego, Calif.
TELEMETERING OF OCEANOGRAPHIC DATA FOR THE NORTH PACIFIC STUDY
R. F. Devereux, R. F. Kosic, Martha W. Evans (Calif. Univ., La Jolla), John D. Isaacs (Calif. Univ., La Jolla), and Richard A. Schwartzlose (Calif. Univ., La Jolla) Jul. 1969 21 p refs Prepared in cooperation with Calif. Univ., La Jolla
(Contract Nonr-3082(00))
(AD-704904; GDC-AAX-70-009) Avail: CFSTI CSCL 9/6

Oceanographic and meteorologic data from the mid-North Pacific are being telemetered daily to a Mobile Data Center situated on the campus of the University of California's Scripps Institution of Oceanography. These data are being collected from a large buoy, in support of Scripps North Pacific Study. Data from smaller buoys are stored internally for routine recovery. The primary objectives of this program are to study the relationship between oceanographic and meteorologic conditions over the North Pacific Ocean, and to study the relationship between Pacific Ocean conditions and climatic conditions over North America. Author (TAB)

N70-32129# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
GEOGRAPHY PROGRAMS Final Report, 15 Mar. 1959–31 Mar. 1970
W. G. Mc Intire 15 Apr. 1970 79 p refs
(Contract Nonr-1575(03))
(AD-705130) Avail: CFSTI CSCL 8/1

The Final Report covers research on Geography Programs, Office of Naval Research, covering the period March 15, 1959, through March 31, 1970. The present program is interdisciplinary in scope, involving three major categories of coastal investigation: coastal environments, coastal dynamics, and coastal information management and model simulation. This activity and the orientation are relevant to user needs. The abstracts of publications presented in this report are listed sequentially by Technical Report numbers. A small section listing reports in press and one outlining those in the miscellaneous category complete the report. Author (TAB)

N70-32141# Woods Hole Oceanographic Institution, Mass.
CRUISE REPORT: CHAIN CRUSE 96
Robert H. Heinmiller Mar. 1970 26 p
(Contract N00014-66-C-0241)
(AD-704074; WHOI-REF-70-14) Avail: CFSTI CSCL 8/3

The cruise was a single-leg cruise, with six moorings to be set and a number, previously set, to be recovered. Both engineering tests and scientific data collection were performed, including tests of armored nylon for fishbite resistance, telemetry capabilitiesm and current measurements in various configurations. In addition, two experiments were made near Bermuda in an effort to determine the shape and trajectory of moorings during free-fall anchor drop. Also, a series of tests was made with the CCTD (Conductivity, Current, Temperature and Depth Instrument). Hydrostations and BTs, as well, were taken. Author (TAB)

N70-32142# Woods Hole Oceanographic Institution, Mass.
CRUISE REPORT: CHAIN CRUSE 90
Robert H. Heinmiller Mar. 1970 26 p
(Contract N0014-66-C-0241)
(AD-704073; WHOI-REF-70-12) Avail: CFSTI CSCL 8/3

Although CHAIN 90 was originally planned as a single leg, the vessel returned to Woods Hole twice during the course of the cruise in order to pick up additional anchors. Eleven moorings were set on this cruise, both short-longer-term, to perform a variety of functions including engineering tests of mooring materials and measurements of sampling intervals on deep stations, shear, electromagnetic transport and current. Two moorings, set on previous cruises, were recovered. Additionally, hydro stations and BTs were taken. Author (TAB)

N70-32225# Woods Hole Oceanographic Institution, Mass.
CRUISE REPORT: CHAIN CRUSE 92
James Gifford Mar. 1970 30 p
(Contract N00014-66-C-0241)
(AD-704075; WHOI-REF-70-13) Avail: CFSTI CSCL 8/3

CHAIN 92 was originally intended as a single-leg cruise, but problems with radio beacons necessitated a return to Woods Hole on June 9th and return to Site D1 on June 10th. Nine moorings were set (two of which were short-term and were retrieved before the end of the cruise) and one previously-established six-month mooring was retrieved. These moorings were to perform a variety of functions including instrumentation and mooring-line materials evaluation as well as collection of scientific data. Other work included hydrostations, XBTs, current-profile measurements in conjunction with the hydrostations, and radar-transponder tests. Author (TAB)

N70-32236# Advisory Group for Aerospace Research and Development, Paris (France).
THE DEFINITION OF SCINTILLATION INDEX AND ITS USE FOR CHARACTERIZING IONOSPHERIC EFFECTS
Herbert E. Whitney *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 3–11 refs
(See N70-32234 17-07)
Avail: CFSTI

The scintillation index (SI) is given as: SI = P(max) - P(min)/P(max) + P(min) where P(max) is the power amplitude of the third peak down from the maximum excursion and P(min) is the power amplitude of the third level up from the minimum excursion. It is concluded that only a relative measure of scintillation index is necessary to describe amplitude fluctuations caused by ionospheric irregularities, and this SI should be used for statistical studies. F.O.S.

N70-32237# Advisory Group for Aerospace Research and Development, Paris (France).
SUMMARY OF PROPERTIES OF F-REGION IRREGULARITIES
Terrance J. Elkins *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 13–37 refs
(See N70-32234 17-07)
Avail: CFSTI

The F-region irregularities are studied for improving its use as a communication medium. For this study, the ionospheric structure is divided into three geomagnetic latitude regions: equatorial zone, polar zone, and temperate zone. The characteristics of each of these regions is reviewed, and the methods of observation are listed. The distribution, size and shape, and movement are discussed with the diurnal, seasonal, and solar activity effects. F.O.S.

N70-32238# Advisory Group for Aerospace Research and Development, Paris (France).
APPLICATION OF THE STATISTICS OF IONOSPHERIC SCINTILLATION TO VHF AND UHF SYSTEMS
Richard S. Allen *In its* Commun. Aug. 1969 p 39–53 refs
(See N70-32234 17-07)
Avail: CFSTI

Statistical summaries and reliable techniques for predicting the effects of ionospheric irregularities at remote locations are studied for application to systems now in use on new radio frequencies. Variations of fluctuations that can be isolated in statistical data are described in terms applicable to communications. These are: stimulus variables that represent changes in forces that produce the irregularities, trait variables, and experimental variables. The magnetic K index is used to relate the variation in response irregularities to variation in the solar energy carried by the solar wind. Charts summarizing the effect of variable factors on the scintillation index are included. F.O.S.

N70-32239# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIAL PROBLEMS IN SCINTILLATIONS
Jules Aarons *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 55–88 refs (See N70-32234 17-07)
Avail: CFSTI

Scintillations in the equatorial region are studied using the stations of Africa and South America. The appearance of scintillations on satellite records, and the effects of diurnal and seasonal influences are discussed. It is concluded that as the midnight sector moves along the geomagnetic equator, irregularities form. The direction of winds within the irregularity structure is eastward at night even though the large scale excitation of the ionosphere into the irregularity formation mode is westward. F.O.S.

N70-32241# Analysis and Computer Systems, Inc., Burlington, Mass.
MATHEMATICAL RESEARCH AND COMPUTER ORIENTED ATMOSPHERIC STUDIES Final Report, Dec. 1968–Dec. 1969
Donald J. Armstrong, Raymond J. Arsenault, Carolyne Mandell, and Alan P. Truesdale Dec. 1969 90 p refs
(Contract F19628-69-C-0095)
(AD-704605; AFCRL-70-0138) Avail: CFSTI CSCL 4/1

The report is the concluding scientific report to record the status and progress of Scientific Analytical Investigations, the preparation of Computer Programs, Data Reduction, and the development of mathematical and computer techniques in support of Environmental Research and other various aspects of the physical sciences concerning the upper atmosphere. During the year covered by this report, the 20 completed programs ranged in complexity and size from conversion of programs from one language or computer system to another, to analysis and development of a large system of analytical programs. Author (TAB)

N70-32257# Swedish Board of Shipping and Navigation, Stockholm. Geomagnetic Section.
THE AEROMAGNETIC SURVEY OF DENMARK, FINLAND, NORWAY, SWEDEN 1965
1969 60 p refs
Avail: CFSTI

Using a three component magnetometer, an aeromagnetic survey of Scandinavia and adjacent waters was completed in the autumn of 1965. The aids of navigation and data processing are discussed, along with residual and magnetic mapping. Magnetic field predictions are also examined from ground stations. Results are presented in contour maps and tables. J.A.M.

N70-32319# Gulf General Atomic, San Diego, Calif.
STUDIES OF SCATTERING OF ELECTRONS FROM ATMOSPHERIC ATOMS AND MOLECULES Final Report, 20 Feb. 1969–31 Mar. 1970
J. F. Williams, K. G. Williams, and J. W. Mc Gowan 2 Apr. 1970 31 p refs
(Contract DAHC04-69-C-0047)
(AD-704982; AROD-8235-1-P; GA-10037) Avail: CFSTI CSCL 7/4

The results of studies of scattering of electrons from atmospheric atoms and molecules are presented. They contain a discussion of the feasibility of the experiment and a description of the apparatus. Basically, the apparatus consists of crossed, pulsed electron and neutral beams with pulse counting detection of the scattered collision products. The experimental studies include helium and molecular nitrogen. Author (TAB)

N70-32349# Air Force Cambridge Research Labs., Bedford, Mass.
ON WATER CLUSTER IONS IN THE IONOSPHERIC D REGION
Rocco S. Narcisi Feb. 1970 18 p refs Presented at the Intern. Conf. on the Universal Aspects of Atmospheric Elec. of IAMD and IAGA of the Union de Geophys. et Geodetique Intern. (4th), and Sci. Council of Japan, Tokyo, 12-18 May 1968
(AD-704548; AFCRL-ERP-314; AFCRL-70-0089) Avail: CFSTI CSCL 4/1

Positive ion composition measurements obtained with rocket-borne mass spectrometers in the lower ionosphere are presented. The current situation regarding the water cluster ions in the D region is considered. Evidence is given in favor of an ambient instead of a contamination origin for the water cluster ions, although the exact processes for the formation of these ions in the atmosphere are still not definitely established. A theory is discussed whereby water cluster ions may be created through the ionization of small water conglomerates, which are assumed both to be present in the mesosphere and to have very low ionization thresholds. Author (TAB)

N70-32363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL AERIAL SURVEY OF KAMCHATKA VOLCANOES
B. V. Shilin et al 6 Mar. 1970 20 p refs Transl. into ENGLISH from Sov. Geol. (Moscow), v. 12, no. 5, 1969 p 139–147
(AD-704830; FTD-HT-23-63-70) Avail: CFSTI CSCL 8/7

The article deals with infrared (IR) aerial surveying as a new, effective method of studying volcanic foci. Basic merit of IR aerial surveying lies in the possibility of obtaining a true instantaneous picture of the heat chart of a volcanic focus. Results from IR aerial surveys of several Kamchatka volcanoes are presented. Author (TAB)

N70-32374# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 4, NO. 4 Quarterly Report
Anne L. Carrigan, ed. 1969 272 p
(AD-704815; QR-4) Avail: CFSTI CSCL 3/2

Contents: Total field intensity magnetometer; Cosmic ray neutron intensity monitor; Extremely low frequency noise; Riometer; Solar optical patrol observations; Solar radio emission; and Vertical incidence ionospheric soundings. TAB

N70-32375# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
DEPENDENCE OF THE OCCURRENCE OF CHORUS UPON THE LOCATION OF THE PLASMAPAUSE Technical Report, Jun. 1966–Sep. 1969
Donald A. Mc Pherson and Harry C. Koons 30 Jan. 1970 47 p refs
(Contract F04701-69-C-0066)
(AD-704817; TR-0066(9220-02)-3; SAMSO-TR-70-82) Avail: CFSTI CSCL 4/1

VLF emissions at 1.3 kHz are observed at altitudes below 1500 km by a VLF receiver aboard spacecraft OV3-3. Correlations of these emissions with local time, magnetic latitude, and the planetary magnetic index Kp show that they have the same characteristic dependence with these parameters as have chorus emissions observed by other satellites and by ground-based stations. The altitude dependence of the magnetic field intensity agrees with that predicted for a wave propagating completely trapped on a tube of force without attenuation. The occurrence of the emission increases with Kp and depends upon the location of the plasmapause. As the plasmapause moves to lower L-shells, the emission occurs more often. A possible explanation for this dependence is the relationship between the growth rate of the

doppler-shifted cyclotron instability and the sharp decrease in electron density at the plasmapause. For frequencies near 1 kHz and electron energies in the range 0.05-1 MeV, the growth rate and region of maximum growth increase as the plasmapause moves to lower L-shells, in agreement with the experimental data. Author (TAB)

N70-32429# PhotoMetrics, Inc., Lexington, Mass.
ANALYSIS OF RELEASES OF TRACER CHEMICALS IN THE UPPER ATMOSPHERE Final Report, 1 Oct. 1968–31 Dec. 1969
Ronald H. Johnson, Irving L. Kofsky, John C. Bowman, and Christian A. Trowbridge 30 Jan. 1970 57 p refs
(Contract F19628-69-C-0091)
(AD-703276; PhM-102-69; AFCRL-70-0074) Avail: CFSTI CSCL 4/1

A program of analysis and interpretation of radiometrically calibrated photographs of chemical releases designed to probe the upper atmosphere is described. Slitless spectra of the early phases of explosive barium releases, made with a high-sensitivity secondary electron conduction vidicon system, were reduced by microdensitometry of the video output display. Precision photographic photometry of a series of AIO clouds were used in a search for high-altitude gravity waves. Time exposures were re-photographed in cine mode for improved visualization of the development and transport of luminous clouds. The procedure by which the data stored on the films are reduced and analyzed is carefully reviewed, and a larger scanning aperture with a much smaller number of sampling points is recommended. Author (TAB)

N70-32498*# TRW Systems Group, Redondo Beach, Calif. Space Science Lab.
AURORAL ROCKET EXPERIMENT 2 Final Report
W. Bernstein, R. L. Wax, and G. T. Inouye 15 Jun. 1970 33 p refs
(Contract NASw-1819)
(NASA-CR-110680; TRW-11228-6008-R0-00) Avail: CFSTI CSCL 04A

A flight demonstration of two instruments for the detection of fluxes of energetic neutral hydrogen atoms assumed to exist in the interplanetary medium was conducted. Analysis of the initial flight data indicates a non-Poisson distribution in the time of arrival of hydrogen atoms at the detector, the lateral spatial extent of the hydrogen forms is less than that calculated earlier for the altitude range at which the observations were made, the dispersion in arrival times of hydrogen atoms of different energies show that particle acceleration or precipitation control processes act at distances less than 1000 km from the rocket, and the hydrogen precipitation shows a nonisotropic pitch angle distribution. A second launching into an auroral breakup indicates the presence of millisecond fluctuations in precipitated hydrogen and electron fluxes. Author

N70-32519# Ionospharen-Institut Breisach (West Germany).
IONOSPHERIC DATA ABSORPTION MEASUREMENTS [IONOSPHAEREN-DATEN ABSORPTIONS-MESSUNGEN]
Dec 1969 14 p refs In GERMAN
Avail: CFSTI

Ionospheric data tables for Freiburg, Germany, represent echo amplitude absorption measurements performed during the period July through December, 1969. Eight different frequencies of 3 min duration were generated in intervals of 22.5 sec from each other with a series repetition of eight times for one half hour. The tables also contain the monthly median values. Transl. by G.G.

N70-32520# Institut d'Aeronomie Spatiale de Belgique, Brussels.
BIBLIOGRAPHY, GROUP 7B. 1: TERRESTRIAL SPACE [BIBLIOGRAPHIE, FASCICULE 7B. 1: ESPACE TERRESTRE]
1969 93 p refs In FRENCH
Avail: CFSTI

A bibliography of current data on ion density in the E, F, and D regions is presented. Transl. by J.M.C.

N70-32578# Hawaii Univ., Honolulu. Radioscience Lab.
ATLAS OF TOTAL ELECTRON CONTENT PLOTS. VOLUME 4: 1 JANUARY–31 DECEMBER 1968
P. C. Yuen and T. H. Roelofs [1969] 385 p
(Grants NSF GP-5404; NSF GA-1113)
Avail: Issuing Activity

Presented are diurnal plots of total electron content versus time obtained at Hawaii by measuring the Faraday rotation of the polarization of VHF telemetry carrier tranmissions from the geostationary satellites Syncom-3 and ATS-1. The diurnal plots contained in this volume have missing data. These have been caused by interruptions in satellite transmissions, breakdowns of our equipment, interference, and other factors. It should be noted that the data are plotted in Hawaiian Standard Time and that if results are needed for the local mean time at the sub-ionospheric point for either satellite-to-Hawaii path, then the proper time correction must be made. The scales used on the plots do not permit the fine structure of the variations in content to be shown. Scintillations are present in the data and can be determined if the data recorded on cards are used. Monthly averages of the content data are included at the end of this volume. Author

N70-32585# Institut d'Aeronomie Spatiale de Belgique, Brussels.
BIBLIOGRAPHY, GROUP 7A. 1: TERRESTRIAL SPACE [BIBLIOGRAPHIE, FASCICULE 7A. 1: ESPACE TERRESTRE]
1969 65 p refs In FRENCH
Avail: CFSTI

A bibliography of current data on geomagnetism, auroras, and airglows is presented. Transl. by J.M.C.

N70-32624# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBILITY OF USING THE TRANSPARENCY METHOD TO DETERMINE THE MICROSTRUCTURE OF AN ATMOSPHERIC AEROSOL
V. G. Bakhtiyarov 20 Feb. 1970 16 p refs Transl. into ENGLISH from Pr. Vysokogornyi Geofiz. Inst. (USSR), no. 8, 1968 p 41–48
(AD-704755; FTD-HT-23-97-70) Avail: CFSTI CSCL 4/1

A discussion is presented on the application of the visibility method in calculating the spectra of the particles in a dispersed system in the free atmosphere, i.e., to determine the size spectra of atmospheric aerosols. The first section of the paper deals with the difficulties encountered in using the method, i.e., determination of the polydispersed scattering coefficient for the significant IR and short wavelengths, in an atmosphere in which radiation is attenuated by absorption by gaseous components and by scattering, and along both off-vertical and horizontal paths. Results obtained by both American and Soviet specialists are compared. The second section deals with problems encountered in making actual horizontal measurements of atmospheric aerosol visibility in the visible, near UV, and IR ranges over paths 5-10 km above the earth. A procedure is presented for determining visibility. The flux of radiation from a source located in the focus of the first mirror passes through the atmospheric layer. Author (TAB)

N70-32638# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF RESULTS OF SPECTROPHOTOMETRIC MEASUREMENT OF THE CREPUSCULAR HALO OF TERRESTRIAL ATMOSPHERE FROM SOYUZ-5 SPACESHIP

K. Ya. Kondratev et al 24 Feb. 1970 22 p refs Transl. into ENGLISH from the Russian
(AD-703547; FTD-MT-24-442-69) Avail: CFSTI CSCL 4/1

The analysis permits the estimate of optimum possibilities of using photographic and spectrophotometric measurement of crepuscular atmosphere from space ships to obtain the vertical profile coefficient of aerosol scattering. As was shown at small approach angles of the sun behind the horizon the vertical gradients of brightness of the crepuscular atmosphere are absent. With increase angle of the sun behind the horizon the intensity of scattered light decreases, and saturation of tones of the color picture decreases; on curves of monochromatic brightness there appear characteristic discontinuities and minima. During the solution of inverse problems of space atmospheric optics, colormetric analysis of obtained optical data should be combined with the analysis of the amount of depression on curves of monochromatic brightness of the crepuscular halo, depending upon the volume concentration of aerosol at various heights, conditions of illumination of crepuscular atmosphere by direct solar radiation, geometry of sighting, and orbit height of the spaceship. Author (TAB)

N70-32645# Naval Postgraduate School, Monterey, Calif.
AN OCEANOGRAPHIC SURVEY OF THE COASTAL WATERS BETWEEN SAN FRANCISCO BAY AND MONTEREY BAY, CALIFORNIA
Peter Stephen Labyak (M.S. Thesis) Oct. 1969 314 p refs
(AD-703645) Avail: CFSTI CSCL 8/10

A detailed oceanographic survey of the coastal waters between Monterey Bay and San Francisco Bay, California, was conducted from 10 through 18 May 1969. Measurements of beam transmittance, sound velocity, temperature, and particulate count were obtained. Over 500 water samples were taken for particulate analysis. The optical properties of this region were found to be very complex. The waters appeared to be affected by flow from San Francisco Bay, littoral material, upwelling, and possibly sewage outfalls during the survey. A greater volume of water with low transmissivity and high particle count existed in the northern region of the survey area than in the southern region. An eddy system between Monterey Bay and Point Ano Nuevo was suggested. Approximately 90 percent of the particles affecting beam transmittance were less than 12 microns in diameter. Particle sizes were found to decrease with increased depths. A fairly good correlation of beam transmittance with particle count was observed except in near shore areas. Author (TAB)

N70-32679# Naval Postgraduate School, Monterey, Calif.
THE MEASUREMENT AND PARTIAL EXPLANATION OF THE EFFECT OF PRESSURE ON THE SPECIFIC ELECTRICAL CONDUCTANCE OF SEA WATER
Robert Erwin Ettle (M.S. Thesis) Oct. 1969 81 p refs
(AD-703642) Avail: CFSTI CSCL 8/10

The increase in specific conductance of sea water with increased pressure was measured using two parcels of sea water (32.448 salinity units and 37.152 salinity units) at six temperatures from 2.39C to 17.39C. The pressure was incremented in steps of 140 decibars to a pressure of 4,000 decibars. Although the effect of pressure on the specific conductance of sea water is nearly linear, it must be described by a higher order polynomial if it is to be used to measure salinity to the usual accuracy required in oceanography. The three major effects that cause the increase in the specific conductance of sea water with increased pressure are shown to be: increased effective concentration due to compression, increased ionic mobility due to the breakdown of Frank- Wen clusters, and the increased disassociation of magnesium sulphate ion pairs. Author (TAB)

N70-32768# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA. VERTICAL-ECHO-SOUNDING: FRIEBURG, URSI-CODE 131 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODEN 131]
Mar. 1970 44 p ref In ENGLISH and GERMAN
(Rept-285-F) Avail: CFSTI

Daily summaries are presented of vertical soundings of the ionosphere over Freiburg, Germany for March 1970. The data include median values for the E and F regions, ordinary wave critical frequencies for the F2 region, minimum virtual height of the different layers, virtual height of the ordinary branch at the frequency 0.834 foF2, and maximum usable frequency for a path of 3000 km for transmission by the F2-(F1-) layer. R.B.

N70-32773# Battelle-Northwest, Richland, Wash.
EVALUATION OF THE SIMPL-1 HYBRID COMPUTER CONCEPT ON A WATER QUALITY BENCHMARK PROBLEM
R. A. Burnett and D. G. Daniels Nov. 1969 28 p refs
(Contract AT(45-1)-1830)
(BNWL-1228) Avail: CFSTI

As part of a study to evaluate the Battelle-Northwest SIMPL-1 hybrid computer concept in comparison to large digital techniques, a hybrid version of an all-digital Columbia River water quality simulation was developed. The discrete-time, discrete-space digital water transport model was transformed into a continuous-time, discrete-space analog model for use in the hybrid program. Identical river and weather parameters were input to both models for a performance comparison. The hybrid results matched the all-digital output almost exactly. A minimum speed advantage of 3.6 to 1 and a machine economic advantage of 55 to 1 was achieved by the SIMPL-1 hybrid program over the all-digital program. Although requiring longer initial setup time, the hybrid program eliminated turnaround time between successive runs and provided the operational conveniences of man-machine interaction and graphic output displays. Author (NSA)

N70-32858# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
OCEANOGRAPHY: A BIBLIOGRAPHY OF SELECTED ACTIVATION ANALYSIS LITERATURE
G. J. Lutz, ed. Jun. 1970 34 p refs
(NBS-TN-534) Avail: SOD $0.50 Catalog No. C13.46:534

A bibliography of selected activation analysis literature for oceanography is presented. Candidates for inclusion in the bibliography were extracted from categories of fish, shellfish, seaweed, marine sediments, and seawater. Author

N70-32931*# Stanford Univ., Calif. Remote Sensing Lab.
PHENOMENA AND PROPERTIES OF GEOLOGIC MATERIALS AFFECTING MICROWAVES: A REVIEW
Deane Oberste-Lehn Apr. 1970 72 p refs
(Contract NAS9-7313)
(NASA-CR-108547; SU-TR-70-10) Avail: CFSTI CSCL 08G

A literature search made on microwave remote sensing included material on electromagnetic theory, parameters affecting passive microwave systems, and properties of natural occurring materials. Some results and conclusions reached were: (1) data on electric and thermal properties of materials are lacking in quality and quantity; (2) systematic analyses are needed of parameters in the microwave portion of the spectrum under conditions that would make the data useful for remote sensing purposes; (3) the complex compositional, structural, and temporally-dependent make-up of the natural environment suggests that even a fundamentally sound knowledge of elemental interactions with electromagnetic radiation is probably insufficient to completely solve real world problems; and (4) the empirical approach of making parametric measurements under carefully selected field conditions may provide better insight into the causes of the integrated responses recorded by passive microwave systems. Author

N70-32969*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
STABILITY OF AN ELECTRON BEAM INJECTED INTO SPACE
R. Krishan Jaggi Washington Jul. 1970 12 p refs
(NASA-TN-D-5842; MSC-S-229) Avail: CFSTI CSCL 04A

The stability was studied of an electron beam injected into space, with the beam assumed to be confined to a cylindrical region and assumed to be in equilibrium under its electric charge and its thermal pressure. A dispersion equation, derived for surface perturbations symmetrical about the axis of the beam, shows that the beam is stable. Author

N70-32970*# Oregon Univ., Eugene. Center for Volcanology.
SEISMICITY INVESTIGATIONS IN THE CASCADE MOUNTAINS AND VICINITY, OREGON, 1 MAY 1969 - 30 APRIL 1970
H. Richard Blank, Jr. and Morris M. Brown 3 Jul. 1970 32 p refs
(Contract NAS9-9690)
(NASA-CR-108539) Avail: CFSTI CSCL 08K

A study is reported of seismicity in the Cascade Mountains and vicinity, Oregon; a cenozoic volcanic region of diverse structural and lithologic aspects which offers an array of terrestrial analogs to lunar and planetary volcanic terrains. Specific objectives of the program included: 1) installation and operation of a seismic station at the suitable site on Pine Mountain in central Oregon; 2) design and fabrication of an ultra-portable seismic system for the detection of micro-earthquakes; 3) determination of absolute and relative seismicities of major Cascades volcanoes by means of reconnaissance micro-earthquake surveys, and 4) comparison of seismicity levels in the High Cascades with seismicity levels in adjacent volcanic provinces. Author

N70-32980# Research Inst. of National Defence, Stockholm (Sweden).
EFFECTS OF NUCLEAR EXPLOSIONS ON THE IONOSPHERE
E. Witalis Feb. 1970 23 p refs In SWEDISH
(FOA-4-4415) Avail: AEC Depository Libraries

In a summarized and an essentially qualitative form the effects of nuclear explosions at ionospheric or higher altitudes are described. A review of the most important aspects of high altitude explosions such as geophysical, cosmophysical, telecommunications, etc., are given. The structure of the ionosphere and its qualities of interest are discussed followed by an investigation of effects of primary ionizing irradiations from nuclear explosions and some more complicated effects from neutron emission and radioactive fission fragments. Finally the effects on the distribution of radio communication signals from the increased ionizations are discussed. Author (NSA)

N70-32990*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
[COSMIC RAY MEASUREMENTS] Final Report
Glenn M. Frye, Jr. 20 May 1970 49 p refs
(Contract NAS9-4411)
(NASA-CR-108559) Avail: CFSTI CSCL 04A

In a search for cosmic gamma radiation above 50 MeV, 60% of the northern hemisphere was surveyed on four balloon flights at 2.5 mbar. Gamma rays were detected by the electron-positron pairs produced in the plates of a 30 gap spark chamber which is sensitive from 50 MeV to 2 GeV, has an angular resolution of 2.6 deg and an HWHM acceptance angle of 20 deg. Author

N70-33000# Christchurch Geophysical Observatory (New Zealand).
IONOSPHERIC DATA, DECEMBER 1969
Dec. 1969 16 p
Avail: CFSTI

Tables of recorded hourly values of foF2, M2000F2, and 1-min data are presented for several areas in New Zealand. Author

N70-33073*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A LINEARIZED APPROACH TO WAVES IN A DILUTE, CHEMICALLY REACTING ATMOSPHERE. PART 1: ANALYTICAL TREATMENT
Kenneth D. Shere (Nebraska Univ.), and Igor J. Eberstein Apr. 1970 23 p refs Submitted for publication
(NASA-TM-X-63956; X-651-70-115) Avail: CFSTI CSCL 04A

A study is made of the behavior of chemically generated waves in a simplified atmosphere. The atmosphere is assumed unbounded, isothermal, one-space-dimensional and initially quiescent. At an initial time a dissociation reaction commences and drives the subsequent wave motion. The fraction of reactant in the atmosphere, X, is assumed to be small. The system of governing equations is then expanded in terms of the small parameter, X, and an integral solution asymptotic to X approaches the limit of 0 is obtained. A series solution in terms of Young functions is also obtained, which are a subspecies of Lommel functions. Author

N70-33096# Environmental Research Corp., Alexandria, Va.
OBSERVED SEISMIC DATA, MILROW EVENT
Mar. 1970 39 p refs
(Contract AT(29-2)-1163)
(NVO-1163-199) Avail: CFSTI

The results are given of the processing of the observed ground motions from the Milrow event. The exact yield of the Milrow event is not known. For the purpose of comparing the observed Milrow ground motions with the ground motions that would be predicted on the basis of data from events detonated at the Nevada Test Site (NTS), the Milrow yield has been assumed to be 1,000 kton. On this basis, the 5% horizontal component Pseudo-Relative Velocity (PSRV) spectra (peak response) calculated from the observed Milrow seismograms were compared with predicted horizontal PSRV spectra for a 1,000 kton event. Similarly, the observed peak particle vector amplitudes as a function of distance were also compared to those predicted for a 1,000 kton event. Author (NSA)

N70-33132# Atomic Energy Board, Pretoria (South Africa).
RARE-EARTH MINERAL DEPOSITS IN THE REPUBLIC OF SOUTH AFRICA
J. W. Von Backstroem Nov. 1969 32 p refs
(PEL-193) Avail: AEC Depository Libraries

Interest in the rare earth metals has quickened considerably in recent years. This tendency has coincided with the development of improved separation and purification techniques and new industrial applications for these metals. The potential resources and reserves of rare earth minerals in South Africa are described, and a summary review of their production, prices, and outlook to the end of 1968 is given. Author (NSA)

N70-33171# Toulouse Univ. (France). Faculty of Sciences.
STUDY OF DIFFUSION IN THE TROPHOSPHERE WITH NATURAL RADIOACTIVE TRACERS [ETUDE DE LA DIFFUSION DE MATIERE DANS LA TROPOSPHERE A L'AIDE DE TRACEURS RADIOACTIFS NATURELS]
Bernard Adroguer (Ph.D. Thesis) 1970 190 p refs In FRENCH; ENGLISH summary
(NP-18186) Avail: AEC Depository Libraries

The validity and the domain of application of the gradient diffusion transport theory are considered for the atmospheric diffusion of the natural radioactivity. Numerical models for the distribution of the radioactive gases and of their decay products in the troposphere have been elaborated (infinite plane source, infinite half plane source, plane source of finite extent). The influence of different parameters on the vertical distributions was studied and the experimental results were interpreted with the help of these numerical methods. The eddy diffusivity profiles were calculated while taking into account its variations with altitude. Author (NSA)

N70-33176# National Center for Earthquake Research, Menlo Park, Calif.
SUMMARY OF SEISMIC ACTIVITY IN THE PAHUTE MESA AREA, NEVADA TEST SITE, 8 DECEMBER 1968 – 30 JUNE 1969
R. M. Hamilton, B. E. Smith, J. C. Hall, and J. H. Healy 1970 64 p refs
(Contract AT(29-2)-474)
(USGS-474-58) Avail: CFSTI

Monitoring of seismic activity in the vicinity of the Nevada Test Site was begun on December 8, 1968. Preliminary results are given to accurately locate earthquakes so that their relation with underground nuclear explosions and geologic structures can be determined. The Benham 1.1 megaton explosion was detonated on Dec. 19, 1968, and initiated a sequence of low-level earthquakes. The low-intermediate (20 to 200 kiloton) Purse Event was detonated on May 7, 1969. The explosion reactivated the Benham seismic zone. The model of seismic velocities used in the earthquake location program was derived from a velocity log obtained in the 4.1 km deep exploration hole Ue20f, a summary of Pahute Mesa seismic characteristics, and a synthesis of the U.S. Geological Survey long distance refraction profiles in the Nevada Test Site region. NSA

N70-33234# Israel Program for Scientific Translations, Ltd., Jerusalem.
STRATOSPHERIC AND MESOSPHERIC CIRCULATION
A. L. Kats 1970 175 p refs Transl. into ENGLISH of the book "Tsirkulyatsiya v Stratosfere i Mezosfere" Leningrad, Gidrometeorologicheskoe Izd., 1968 Prepared for ESSA and NSF
(TT-69-55110) Avail: CFSTI

Observational data for the stratosphere and mesosphere of various latitude zones accumulated so far is summarized, and the investigations of various problems in this field are discussed. The physical processes taking place in the equatorial stratosphere and mesosphere are analyzed. The vertical structure of the zonal and meridional circulation components in the tropical troposphere and lower stratosphere are examined. Oscillations of zonal winds in the lower equatorial stratosphere are discussed and various hypotheses as to their nature are presented. The seasonal characteristics of these oscillations and their relation to the general circulation in the lower stratosphere are studied. The circulation in the upper equatorial and tropical stratosphere and mesosphere and the interrelationship between oscillations in the lower and upper equatorial stratosphere are discussed. Some aspects of the circulation of the extratropical stratosphere and mesosphere are prescribed with their interrelation with tropical and equatorial stratospheric processes. The conclusion summarizes the fundamental results of the discussion, and considers aspects of the application of stratospheric circulation to the construction of long-range weather-forecasting methods. Author

N70-33236# Lockheed Missiles and Space Co., Palo Alto, Calif.
MEASUREMENT OF THE ELECTRON CONCENTRATION OF THE IONOSPHERE BY THE HIGH FREQUENCY IMPEDANCE PROBE METHOD
G. P. Komrakov et al [1970] 5 p Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 8, no. 2, 1970 p 278 – 283
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An electrically short antenna, in which the impedance can be considered a pure capacitance, is utilized in the high frequency impedance method. The electron concentration in the ionosphere was determined by measuring the magnitude of the change in antenna capacitance as a function of the change in the dielectric constant of the ionosphere at two fixed frequencies. A brief description of the apparatus is presented and a profile of the electron concentration at altitudes from 80 to 170 km obtained with the equipment is included. D.L.G.

N70-33237# Joint Publications Research Service, Washington, D.C.
CONQUEST OF THE DEPTHS
M. N. Diomidov et al 22 Jun. 1970 68 p refs Transl. into ENGLISH from the book "Pokereniye Glubin" Leningrad, Shipbuilding Publishing House, 3 Oct. 1969 68 p
(JPRS-50791) Avail: CFSTI

An overview is presented of technological research in the Soviet Union concerning underwater exploration. Submergence vehicles and onboard instrumentation are discussed along with methodology and obstacles involved in penetrating the ocean depths. Particular emphasis is placed on studies conducted with the Giprorybflot hydrostat and the Sadko underwater laboratories. In addition, a discussion is offered on submarine technology of the future and includes the foreseeable goals resulting from the use of advanced equipment and scientific knowledge. D.L.G.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-32039# Defense Documentation Center, Alexandria, Va.
COLOR PHOTOGRAPHY, VOLUME 1A DDC BIBLIOGRAPHY, MAR. 1960 – DEC. 1969
Apr. 1970 118 p refs
(AD-704900; DDC-TAS-70-42-1) Avail: CFSTI CSCL 14/5

The bibliography contains annotated references ranging from techniques for producing color pictures from black-and-white negatives to using aerial photography in different spectrum intervals to study vegetation and soils. References include methods for compiling large-scale soils maps using aerial photographs; pseudocolor enhancement of biomedical images; and photoelectronic color separation by servomechanisms in cartography. Specialized photosensitive materials for laser research are also discussed. Author (TAB)

N70-32133# Stanford Univ., Calif. High Energy Physics Lab.
NEW DETECTORS FOR HIGH-ENERGY PHYSICS
Robert Hofstadter 1969 14 p refs Submitted for publication
(Contract Nonr-225(67))
(AD-703716; HEPL-599) Avail: CFSTI CSCL 18/4

A total absorption technique is developed for the detection of electromagnetic and strongly interacting particles. Author (TAB)

N70-32145*# Marquardt Corp., Van Nuys, Calif. Propulsion Div.
EVALUATION AND DEMONSTRATION OF A PROPELLANT QUANTITY GAGING SYSTEM FOR AUXILIARY

PROPULSION SYSTEMS Final Report
S. R. Tate and R. J. Hromadka Feb. 1970 60 p
(Contract NAS8-21488)
(NASA-CR-102759; S-968) Avail: CFSTI CSCL 09E

A propellant quantity gaging system for auxiliary propulsion systems utilizing earth storable propellants was investigated. The gaging system utilizes a sensor and associated logic to determine the flow through the engine solenoid valves. A major advantage of this system is that it does not breach the electrical or propellant circuits of the propulsion system in any way. Multiple engines firing simultaneously to identical or different duty cycles may be monitored. The gaging system provides a digital output of the propellatn remaining in the propulsion system at any time. A breadboard and flight weight version of the gaging system were fabricated and used to demonstrate operation to typical space requirements. Analysis of mission errors and gaging system verification tests with a 22 lb thrust bipropellant engine demonstrated that a system accuracy of better than 2% can be obtained. Author

N70-32151# Advisory Group for Aerospace Research and Development, Paris (France).
TESTING OF AIRBORNE AVIONICS SYSTEMS Conference Proceedings
Mar. 1970 473 p refs Mostly in ENGLISH; partly in FRENCH Presented at AGARD Avionics Panel 18th Tech. Symp., Tonsberg, Norway, 6-9 Oct. 1969
(AGARD-CP-51) Avail: CFSTI

The conference papers presented pertain to operational requirements, avionics system testing concepts, built-in test equipment, onboard test equipment, automatic test equipment, and automatic test equipment software. For individual titles, see N70-32152 through N70-32179.

N70-32152# Department of the Air Force, Washington, D.C.
THE TESTING OF AIRBORNE AVIONICS SYSTEMS: THE OPERATIONAL REQUIREMENT
Archie T. Iddings *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 6 p (See N70-32151 17-14)
Avail: CFSTI

A nontechnical overview of the Air Force operational requirement for automatic test equipment (ATE) and aircraft integrated data systems (AIDS) is presented. The Air Force requirements process is discussed briefly to provide an understanding of the problems encountered in taking a 'paper' requirement, particularly a support requirement, through the various stage of 'advocacy' to actual hardware. Various requirements for AIDS, ATE, and related equipment are viewed and discussion is given to the formative process which led to and AIDS program. Air Force philosophy regarding the relationship between inflight and ground checkout equipment is discussed and addresses the question of standardized versus peculiar test equipment. Author

N70-32153# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
DYNAMIC INTEGRATED FLIGHT LINE CHECKOUT OF AVIONICS SYSTEMS
D. E. Brown and E. W. Buebel, Jr. (AAI Corp.) *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 9 p (See N70-32151 17-14)
Avail: CFSTI

Integrated dynamic tests at flight line maintenance echelon for weapon systems are proposed. Built-in tests are recognized as essential to the weapon system. It is concluded that built-in tests cannot functionally replace the ground based tester. Both dynamic and integrated tests are required to thoroughly test the system. The alternatives to the proposed test concept are static and subsystem tests. These alternatives fail to evaluate the system as the system operates on mission. The tester used to implement the concept must have an automatic mode with ample provisions for operator intervention. The automatic program must be flexible so that it can be easily changed to track system changes. The concept has had varying degrees of application on the F-101, F-102, F-104, F-106, and F4 weapon systems with good results. It is included in the test concepts for the A-7 and F-15. Author

N70-32155# Bendix Corp., Detroit, Mich. Navigation and Control Div.
AUTOMATED PRODUCTION TESTING AND TROUBLESHOOTING OF AVIONICS PRODUCTS
Mario Antonazzi *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 14 p (See N70-32151 17-14)
Avail: CFSTI

A study of the application of automated testing and troubleshooting in an electronic manufacturing plant is presented. A major facility, based on the AN/GJQ-9 Programmer-Comparator was established; its development and operation over the past five years has generated a store of practical experience which was of considerable value in directing further automatic test equipment development and application. An automatic fault isolation test system for circuit boards was completed and is in operation. This computer-controlled system uses guarded measurements and a novel test fixture for making in-circuit component tests. The system concept is based on a trade off of troubleshooting cost savings versus recurring costs (software, adapters). A facility being planned will incorporate the computer-controlled automatic test equipment as the key element in an overall plan to minimize redundant development of equipment, programming and troubleshooting techniques between factory, aircraft manufacturer and maintenance shop. Author

N70-32156# Polhemus Navigation Sciences, Inc., Burlington, Va. Director of Engineering.
A TECHNIQUE FOR ESTABLISHING THE COST-EFFECTIVENESS OF AVIONICS SYSTEM TESTING CONCEPTS
Donald W. Richardson *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 17 p Sponsored in part by Hughes Aircraft Co. (See N70-32151 17-14)
Avail: CFSTI

A tool is provided for the major airframe/avionics system contractor. This tool is a technique of analysis of the effective feasibility of the elements of the avionics system on an aircraft, as achieved by a variety of test approaches such as off-board ATE, on-board computers, BITE, etc. The results of this analysis will provide the major systems contractor with preliminary information upon which to base his major decisions regarding the maintainability concept to be implemented into the prime vehicle (and perhaps also into the overall operational maintenance environment). However, the level of this analysis is not specifically constrained to an evaluation of the technical details of particular avionics test concepts. In actuality, the major systems designer must make his decision based on the total cost effectiveness of any particular concept. The expansion of the original testability analysis into an overall cost effectiveness analysis of the implementation of any candidate testing concept into an operational situation is treated. The conclusion presents a suggested set of guidelines and procedures for the performance of a cost effectiveness analysis of various concepts of testing avionics systems. Recommendations are made concerning the utility of this technique for making initial decisions early in the design cycle of a project. Author

N70-32157# Royal Air Force, Farnborough (England).
AIRBORNE INTEGRATED DATA SYSTEMS (AIDS) FOR AIRCRAFT MANAGEMENT
M. C. Whiteley *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 15 p refs (See N70-32151 17-14)
Avail: CFSTI

The concept of real time measurement of aircraft parameters as part of an airborne integrated data system (AIDS) to improve aircraft management is introduced. The application of AIDS to improve aircraft maintenance and mission performance is examined with particular emphasis on determining the likely benefits of AIDS in improved aircraft availability. Special consideration is given to examining the cost flow of defects in obtaining a mathematical model of the maintenance of aircraft based on reliability theory. The means of assessing the effectiveness of AIDS as a maintenance tool and its relationship to built-in test equipment (BITE) and automatic test equipment (ATE) is discussed. The future importance of AIDS as a means of assessing mission effectiveness and its role as an overall management tool for both civil and military aircraft is examined. Author

N70-32158# British Aircraft Corp., Preston (England).
THE INTERDEPENDENCE OF 'BUILT IN', 'ON BOARD' AND 'GROUND BASED' TEST FACILITIES
A. S. Delahunty and A. G. Hayes *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 15 p (See N70-32151 17-14)
Avail: CFSTI

Testing is carried out to enable a decision to be taken: either to use an aircraft, system or avionic unit, or to repair or replace it. When the decision is to repair, diagnostic testing is then necessary to locate the fault, and subsequently performance testing is required to ensure that the repair was effective. The ground equipment is either manual or automatic (or both) and again the best economic mix must be chosen for the particular application and for each echelon of servicing. As an example, a logistic exercise on an aircraft is described, to show the flow diagram of a particular type of fault finding procedure to illustrate clearly the part that each test system plays in the maintenance of the aircraft. Difficult areas are highlighted, for instance those associated with certain types of inertial component. Author

N70-32159# Radio Corp. of America, Needham, Mass.
INTERRELATION OF ON-BOARD AND GROUND ATE IN ACHIEVING THE MOST EFFECTIVE OVERALL SUPPORT SYSTEM
O. T. Carver *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 14 p refs (See N70-32151 17-14)
Avail: CFSTI

In order to evaluate alternate concepts for on-board and ground test systems, their effect on the total support system must be measurable. This points to a need for quantitative measures of effectiveness for the overall support system. Measures of support system effectiveness are developed relating prime equipment availability as a function of the support system and the total cost of providing that support. Simulation models, applied to the support system, are used to test alternate methods of support during early development so that trade-offs can be made between the prime and support system as well as within the support system. A number of examples are used to illustrate the use of support system models. Author

N70-32160# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
BUILT IN TEST EQUIPMENT FOR ADVANCED FLIGHT GUIDANCE SYSTEMS
Martin Feintuch *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 9 p (See N70-32151 17-14)
Avail: CFSTI

A comprehensive discussion of built-in test equipment is presented including: 1) its advantages and disadvantages compared to automatic and on board test equipment, 2) the necessity for testing only the least reliable components, 3) the need for employing a fail safe testing technique, and 4) the advantages and disadvantages of end to end testing compared to sub-module testing. The critical reliability considerations are discussed including: 1) the reliability of the test equipment versus that of the object system, 2) the failure rate of the object circuits compared to the time between overhauls, and 3) the selection of those object circuits which must be tested in order to meet a specified testing confidence. The implementation of fail safe hybrid testing circuitry is presented. In addition, sample testing programs are presented which represent tests of a single channel and a dual channel automatic flight control system. A comparison of the difficulty in testing single, dual, and triple channel systems is also made. Author

N70-32161# Philco-Ford Corp., Blue Bell, Pa. Communications and Technical Services Div.
BUILT-IN TEST EQUIPMENT USING AUTOMATED DIAGNOSTIC PROCEDURES
J. A. Jurenko and J. W. Mc Nabb *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 12 p ref (See N70-32151 17-14)
Avail: CFSTI

A method is presented for designing and incorporating automatic Built-In-Test-Equipment (BITE) into avionics communications equipment that is both efficient in terms of fault location as well as low cost relative to the overall hardware. This presentation includes basic design philosophy, specific design techniques, and a discussion of implementation of BITE. Since BITE can also be used to great advantage in production and inspection, this aspect is considered during the original design. Recent advances in the art of BITE were made through application to a new line of avionics communications equipments. Several types of communications equipments have been designed with BITE which includes a Fault Location Facility (FLF). The FLF provides a means for isolating faults to printed circuit board level or module level by testing all active circuits. In designing equipment, many electronic functions which were previously considered practical only in analog form, are now performed quite readily utilizing digital techniques. These techniques lend themselves to the incorporation of BITE and FLF as an integral part of the equipment. Two types of FLF can be incorporated into equipment and these are described. The first test feature, which exercises the equipment in real time, permits automatic detection of equipment failure. The second test feature, which is an off line test, provides the means for isolation of faults to the printed circuit board or replaceable module level. All active components are tested by this procedure. Author

N70-32162# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
INDIVIDUALLY BUILT-IN SELF TEST TECHNIQUES AS APPLIED TO TERRAIN-FOLLOWING RADAR SYSTEMS
Fred H. Behrens and Charles C. Freeny (Gen. Dyn., Fort Worth, Tex.) *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 13 p refs (See N70-32151 17-14)
Avail: CFSTI

The BIT design considerations are discussed in terms of primary and secondary BIT problems. The primary problems are those directly related to flight safety and the secondary problems are those normally associated with avionics BIT design (malfunction isolation). TFR BIT design tradeoff techniques are discussed relative to basic signal tests (continuous versus sampled) and failure reaction requirements (automatic versus manual). The basic BIT parameter design selected for the F-111 is presented in terms of the above mentioned BIT signal properties and failure reaction categories. Analysis, simulation, and flight test techniques for developing the test tolerances needed to assure safe flight over a wide spectrum of terrain variation flight loads, and flight velocities are discussed. Resultant BIT performance is expressed in terms of probability of false alarm versus probability of terrain clobber. An associated system design concept is presented, which allows the BIT complexity to change when the mission requirements change. An extension of current BIT techniques, wherein comparison is

made with independent reference signals, is suggested, although the extension would require parameter reliability weighting, so as to not increase the false-alarm rate. Author

N70-32163# Elliott Flight Automation, Ltd., Rochester (England).
SYSTEM INTEGRITY AND FAULT ISOLATION VIA BITE
L. E. Handley *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 13 p (See N70-32151 17-14)
Avail: CFSTI

The role of B.I.T.E. in performance monitoring and fault detection is discussed. The benefits of B.I.T.E. are considered and there is a detailed consideration of the operational penalties associated with B.I.T.E. as well as the problems of implementation. System design of B.I.T.E. for particular types of equipment is considered and a head-up display system is selected to show an example of the application of B.I.T.E. The importance of careful consideration of all factors at the system design stage to obtain the most cost effective solution is stressed. Author

N70-32164# Elliott Flight Automation, Ltd., Rochester (England).
THE INTERNAL AVIONICS: TEST EQUIPMENT INTERFACE
R. C. Bareham *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 14 p (See N70-32151 17-14)
Avail: CFSTI

It is shown that by orienting the design in a suitable manner it is possible to achieve a high level of BITE with the minimum additions of hardware. The techniques are divided between analogue equipment and digital equipment. Details of techniques best suited to either a hardware or software approach are discussed. Throughout the paper detailed examples are given where the principles proposed have been successfully applied. In addition it is shown that by careful design, BITE may also be used as an invaluable aid during commissioning. The operational value of an end to end confidence check is illustrated for the case where the final output may be assessed by either pilot or aircrew. Author

N70-32165# Smiths Industries, Ltd., Cheltenham (England). Aviation Div.
THE INFLUENCE OF TESTING REQUIREMENTS ON CIRCUIT AND SYSTEM DESIGN OF AVIONICS EQUIPMENT
A. G. Studd *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 18 p (See N70-32151 17-14)
Copyright. Avail: CFSTI

The constraints placed on circuit and system design by the various testing situations encountered during the life of avionics equipment are discussed. A big improvement in the efficiency of flight line testing is required and this is one of the major goals of the next decade. The trend towards including BITE features continues even in relatively simple systems such as those provided for engine parameter measurements as well as in more sophisticated systems such as those provided for flight control. It is inevitable that there will be much more integration of these various BITE features in the future. Unit testing requirements by both manufacturer and user lead to modular forms of construction using planar assemblies where possible. Subassemblies should be functional as well as physical entities with simple input-output interfaces and interchangeable without consequential adjustments. Test points should be provided to assist in fault location to subassembly and component level. Author

N70-32166# Polhemus Navigation Sciences, Inc., Burlington, Vt. Director of Engineering.
WHAT PRICE ON-BOARD TESTING: IMPACT ON TACTICAL AIRCRAFT AVIONICS
Donald W. Richardson *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 12 p Sponsored in part by Hughes Aircraft Co., Culver City, Calif. (See N70-32151 17-14)
Avail: CFSTI

The trade-offs between various configurations of on-board fault detection and fault isolation systems with particular emphasis on the critical parameters of weight, volume, power, and cost are considered. Since the majority of tactical weapons systems envisioned in the 1970-1975 time era utilize one or more digital computational elements in either a federated (multiple computer) system or an integrated (central computer) system configuration. For a given set of system requirements (number of test parameters, number of line replaceable units, number of functional subsystems), the following on-board test system configurations were investigated within the framework of a typical advanced tactical/fighter type aircraft: (a) use of the existing central computer in an integrated system concept as a testing device, (b) addition of a system testing function to one or more of the existing multiple computers in a federated system concept, and (c) addition of a separate computer system whose primary function is on-board testing and fault isolation. Each of the above alternate configurations were investigated as to the increase in system volume, weight, power, and cost incurred by inclusion of the particular on-board testing concept into the existing base-line avionics system configuration. Author

N70-32167# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
SYSTEMS APPROACH TO ON-BOARD CHECKOUT
W. Butler and L. McDonough *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 9 p (See N70-32151 17-14)
Avail: CFSTI

Two on-board checkout (OBC) systems are described, each of which features a different approach to avionic systems self-test. Both approaches utilize the capability of an on-board computer and CRT display. A comparison of these systems and development tradeoffs are presented. The first OBC approach is applicable to equipments having either continuous built-in test (BIT) or command actuated BIT capability. Continuous BIT can report a NO-GO status at any time during flight. Command-actuated BIT reports a NO-GO status only as a result of an operator or program command. In either case, the report of a NO-GO status causes the executive program to branch to the OBC subroutine. During this subroutine, the computer steps a multiplexer to establish the identity of the failed equipment, which is displayed to the flight crew. The second OBC approach includes checking equipments which only provide monitor points. Under control of the OBC program, which is accessed several times during the flight, a multiplexer-converter is activated and performance data is stored in memory. A program analysis of the data is performed, which results in a GO/NO-GO evaluation of each equipment and a display of each failed equipment. These two approaches are complementary and, therefore, there is no conflict in applying both to any weapons systems. Author

N70-32168# Rolls-Royce, Ltd., Bristol (England). Engine Div.
DIGITAL CONTROL SYSTEMS SELF-CHECK
E. Roberts *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 12 p (See N70-32151 17-14)
Avail: CFSTI

Checkout methods in a digital control system, using the control computer as a test-set are described. This approach, which can be applied to most digital control systems, results in very fast checkout with low cost and weight penalties. The principles and objectives of checkout of a jet engine control system are discussed, and the methods and their application to an experimental control installation are described. In this installation the fully automatic pre-flight check took about 10 seconds, while the partly automatic 'once per day' check took less than 30 seconds. Extension of the methods to a 4-engined variable geometry installation (with eight control lanes) is described. The pre-flight checkout time for such

an installation is estimated at less than 1 minute, while the additional equipment mainly comprises a simple control panel, several hundred 'words' of computer storage, and about 0.1% increase in the volume of electronics. Author

N70-32169# IBM France S. A., Paris
TESTING OF ON BOARD AVIONIC SYSTEMS [ESSAIS DE SYSTEMES AVIONIQUES DE BORD]
B. Bachelot *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 22 p In FRENCH (See N70-32151 17-14)
Avail: CFSTI

A number of solutions that were proposed for the testing of equipment onboard modern aircraft are considered. A synthetic table of the different philosophies is considered along with an analysis of the advantages and disadvantages of these concepts. Emphasis is placed on treatment of the onboard information and the interface problem of flight maintenance. Transl. by J.M.C.

N70-32170# Hawker Siddley Dynamics, Ltd., Hatfield (England). Electronic Equipment Dept.
TESTING AVIONIC SYSTEMS AUTOMATICALLY: THE ECONOMICS SCOPE AND ESSENTIALS
A. H. Parker *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 30 p (See N70-32151 17-14)
Avail: CFSTI

The feasibility of automatically testing avionic systems is considered with emphasis on the advantages of the automatic system as opposed to the manual system. Practical economic and essential considerations are given the system configurations in terms of increasing the speed and reliability of the testing method. Additional theoretical data are appended. J.M.C.

N70-32171# Messerschmitt-Boelkow G.m.b.H., Munich (West Germany).
AUTOMATIC TEST EQUIPMENT: HARDWARE AND SOFTWARE EXAMPLES; POSSIBLE CLASSIFICATION
Horst Reimann *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 12 p (See N70-32151 17-14)
Avail: CFSTI

The concepts of the automatic test equipment are presented for: the experimental Eldo 3rd stage, the Azur sounding rockets, the operational Eldo 3rd stage, a ground to ground missile system, the orbital operations system for satellites, and a hybrid automatic test system. A brief discussion of SCOPE (simple checkout oriented program language) is followed by a classification of the presented automatic test equipment. Author

N70-32172# McDonnell Aircraft Corp., St. Louis, Mo.
AUTOMATIC TEST EQUIPMENT IMPLEMENTATION TECHNIQUES TO REALIZE COST EFFECTIVE SUPPORT
James L. Brierton *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 16 p (See N70-32151 17-14)
Avail: CFSTI

The techniques and procedures used to successfully adopt ATE for U.S. Air Force depot applications are explained. Implementation plans must be formulated early in an ATE program to realize cost effective support. Trade-off studies to determine comparative testing technique costs were improved using mathematical models. Specifications were also developed defining avionic suppliers' responsibilities for supplying detailed documentation of test definitions, ATE capabilities, and interface hardware, tapes, tape manuals, and avionics. Finally, procedures were developed to demonstrate hardware and software compatibility to the customer's satisfaction. Author

N70-32174# Autonetics, Anaheim, Calif.
APPLICATIONS OF A PROGRAMMER-COMPARATOR TO AVIONICS SYSTEMS OFF-LINE TESTING
John L. Hastie *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 11 p refs (See N70-32151 17-14)
Avail: CFSTI

The automatic testing features and characteristics of a programmer-comparator with the conventional approach to testing utilizing manual test equipment are contrasted. Attention is focused on the economic and technical advantages to be realized using programmer-comparator-controlled test stations to perform avionics systems off-line testing. Data are presented which illustrate the significant advantages realized through the use of programmer-controlled automatic test equipment (ATE) in the areas of testing accuracy, validity, reliability, and test repeatability. Additionally, the test time savings and aircraft availability factors are reviewed. These data confirm the testing objectivity, consistency, and thoroughness, regardless of changes in the operator/equipment environment over a prolonged time period. Reviewed also are the present and anticipated states-of-the-art of ATE, illustrating the introduction of a microminiature version of the programmer-comparator test center and evaluating the application of computers within the ATE environment. Author

N70-32175# Advisory Group for Aerospace Research and Development, Paris (France).
TESTING OF AIRBORNE AVIONICS SYSTEMS: A SIMPLIFIED PROGRAMMING SYSTEM USING COMPUTER SUB-ROUTINES
E. W. Carr and M. E. Walker *In its* Testing of Airborne Avionics Systems Mar. 1970 22 p (See N70-32151 17-14)
Avail: CFSTI

It is shown how computer subroutine techniques can be used in automatic test equipment to reduce the delays inherent in off-line programming by making it possible for a test engineer to create his own test program directly on the automatic tester. The subroutines are called MACRO's in this particular application since they consist of a series of discrete machine instructions designed to operate the automatic tester in a particular way but unlike subroutines the program instructions are incomplete and require that certain variables be specified by the operator to suit his particular test needs before the MACRO will operate the automatic tester completely. Using this type of automatic tester the operator has at his fingertips all the programming expertise of the test engineers and computer engineers who designed the automatic tester without the need to study the machine code programming in great depth. At the same time the cost and complications of a high level language compiler are avoided. Author

N70-32176# Aerojet-General Corp., Covina, Calif.
TEST TECHNIQUES EMPLOYED FOR STATE-OF-THE-ART AIRBORNE INFRARED EQUIPMENT
Eugene W. Mc Callion *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 6 p (See N70-32151 17-14)
Avail: CFSTI

A brief review of test equipment and techniques employed with operational infrared equipment is made. Infrared systems currently in advanced stages of development require a different approach and equipment to provide a rapid and meaningful method of evaluation. A proposed technique and the associated equipment are described. The basis of the technique is the application of the modulation transfer function to the individual components or the whole system to provide determination of the prime criteria, thermal and spatial resolution. Author

N70-32177# Standard Electrik Lorenz A. G., Stuttgart (West Germany).
AUTOMATIC TEST EQUIPMENT FOR ORTAC, A VTOL AIRCRAFT MOBILE LANDING AID
Manfred Boehm *In* AGARD Testing of Airborne Avionics Systems

Mar. 1970 17 p (See N70-32151 17-14)
Avail: CFSTI

Following basic considerations on the test philosophy, a system for automatic testing of a landing aid for VTOL aircraft is described. This system is to be used in the flight line before each mission. The landing aid consists of ground and airborne equipment. The test system autonomous to be used on ground only - much allow detailed drift measurements as well as go-no-go tests. Another requirement is simple fault location. Operation is to be computer controlled, but antonomous operation shall also be possible. Environmental conditions are specified in MIL-STD-810B. Following a review of solutions possible in principle, the chosen configuration is described. Type and number of parameters to be tested, and reasonable equipment effort are compared with one another. Advantages and shortcomings of a standardized building block system as well as cost effectiveness are discussed. In conclusion, ideas on the desirable future trends in BITE, flight line, and shop level testing are given. Author

N70-32178 Sud-Aviation, Toulouse (France).
DESIGN STUDY FOR AN ADVANCED AUTOMATIC TEST EQUIPMENT (ATE)
M. R. Coppee *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 5 p (See N70-32151 17-14)
Avail: CFSTI

The system presented is a general purpose automatic equipment used to test any kind of aircraft units at the overhaul shop. The requirements, the test philosophy and the solutions, as studied and developed in an advanced automatic test equipment complex are discussed. Author

N70-32179# Siemans A.G., Munich (West Germany).
TEST EQUIPMENT FOR AIRBORNE IFF INTERROGATORS AND TRANSPONDERS
Dietmar E. Haensch *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 13 p (See N70-32151 17-14)
Avail: CFSTI

The present IFF system, Mark X-SIF, used in the NATO countries makes it possible to distinguish whether a radar target is a friend or foe; the former sends out a special reply code upon interrogation. Since an undetected fault in the interrogator or transponder can lead to a friend being mistaken as an enemy target, extensive tests on the IFF equipment are of particular importance. In the present generation of IFF equipment the test concept still rests largely upon manual testing. Add-on devices fitted later permit service supervision during flight. The modern generation of IFF airborne equipment has built-in test equipment (BITE), for performance tests during a mission. A more exact test of the whole IFF system is carried out on the ground with the aid of automatic test equipment. Author

N70-32261*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MERCURY ELECTROCHEMICAL COULOMETER AS A BATTERY STATE-OF-CHARGE INDICATOR
Richard R. Secunde and Arthur G. Birchenough Washington Jul. 1970 19 p refs
(NASA-TN-D-5773; E-5331) Avail: CFSTI CSCL 09E

Use of a mercury-column electrochemical coulometer is discussed as a means for indicating the state of charge of secondary-battery systems through ampere-hour integration. The general nonlinear charge-discharge characteristics of a battery were matched through the use of operational-amplifier techniques. Results of electrical and temperature tests demonstrate that a coulometer of this type is a feasible device around which a battery state-of-charge indicator might be built. Author

N70-32264# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
REMOTE SENSING OF COASTAL WATERS USING MULTISPECTRAL PHOTOGRAPHIC TECHNIQUES Final Technical Report
Edward Yost and Sondra Wenderoth 1 Jan. 1970 219 p refs
(Contract N00014-67-C-0281)
(AD-705116; SERG-TR-10) Avail: CFSTI CSCL 14/5

An evaluation of multispectral photographic techniques for optical penetration of water in Northeastern United States and Gulf of Mexico coastal waters showed the green spectral band to maximize the detectability of underwater targets. This type of particulant matter in suspension in the water as well as the size and quantity of the particles significantly affects the ability to optically penetrate water. In general, the spectral band (493-543nm) when exposed to place the water mass at about unity density on the photographic emulsion, was found to give the best water penetration independent of altitude or time of day as long as solar glitter from the surface of the water was avoided. When optimally exposed, the images of surface and underwater objects showed greater chromatic enhancement in multispectral color renditions than on conventional Aerial Ektachrome color films. Multispectral negative color renditions were found to be equally as good as positive color images for achieving color differences between the water mass and submerged objects. An isoluminous color technique has been perfected. This photographic process eliminates the dimension of brightness from a multispectral color presentation. By this method, objects exhibiting subtle spectral differences which are normally obscured by the comparatively large brightness present in coastal waters can be detected. Author (TAB)

N70-32276*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT CONTROL
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 149-164 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 22B

Spacecraft attitude and reaction control, and filtering studies are discussed. A digital attitude control system simulator for the Thermoelectric Outer Planet Spacecraft is described, and the effects of the spacecraft's flexible structure on the attitude control sensors are analyzed. A failure detection system for the Mariner-type solenoid actuated, cold gas reaction control system was tested and results show the feasibility of the concept for leak detection. Simple Wiener-type, minimum steady state variance constant gain nonlinear filters are compared to more complex filters. N.E.N.

N70-32277*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATERIALS
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 165-170 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 20K

Materials for spacecraft thermal control and pressure vessels, and microstrain measuring techniques are discussed. Vacuum photolysis tests of the effectiveness of additives on ZnO indicated ZnO to be a potential thermal control material, and ZrO2 and La2O3 were found to be unsatisfactory. Test procedures and equipment for studying fracture mechanics of pressure vessel materials are described. Techniques are reviewed and evaluated on the basis of their ability to measure the micro-stress-strain behavior of photoheliograph mirror materials for the Apollo Telescope Mount. N.E.N.

N70-32291*# Naval Research Lab., Washington, D.C.
DEVELOPMENT OF ELECTRONOGRAPHIC IMAGE CONVERTERS FOR FAR-ULTRAVIOLET SPACE ASTRONOMY APPLICATIONS
G. R. Carruthers *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun.

1970 p 41–47 (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

The image converters for far-ultraviolet stellar spectroscopy and for direct star field imaging in selected far-ultraviolet wavelength ranges are described. The problems associated with film fogging and ion spotting due to outgassing from the payload outside the experiment package are discussed. The tests show that a suppressor grid or focal plane shutter are not required in an all-reflecting instrument due to the large open area around the film, whereas they are required in Schmidt-type instruments. R.B.

N70-32299*# Biddle (James G.), Co., Plymouth Meeting, Pa.
LOW-LEVEL CORONA DETECTORS
P. H. Reynolds and C. J. Saile *In* JPL Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 117–122 refs (See N70-32286 17-09)
Avail: CFSTI CSCL 09E

The problem of the detection of pulse signals in insulation systems resulting from the application of alternating voltage is discussed. Consideration is given to the effect of detection system bandwidth, response, and integration time. Particular emphasis is given to tests on insulation systems which may be considered to have distributed parameters or secondary resonances, rather than those which are lumped or simple 2-terminal specimens. The techniques described which permit accurate measurements on distributed insulation systems are equally applicable to the case where lumped systems are to be tested. Author

N70-32355# Naval Ordnance Lab., White Oak, Md. Chemical Engineering Div.
INSTRUMENTATION FOR RECORDING A SEMI-LOGARITHMIC PLOT OF TWISTING CYCLES VERSUS STRESS FROM A MULTIAXIAL FATIGUE TEST
Nicholas A. Vogle and Paul A. Kendall 15 Dec. 1969 13 p refs
(AD-704784; NOLTR-69-161) Avail: CFSTI CSCL 14/2

A composite plastic half ring specimen is subjected to a fixed rotational displacement for which a semi-logarithmic record is automatically obtained for a 10,000 twisting cycle range. Three multi-level stepping switches are arranged to record the maximum stress for 23 preselected cycles on a X-Y plotter. A manual control is also available to record the stress for any other desired cycles. Author (TAB)

N70-32382# Columbia Univ., New York. Radiological Rsearch Lab.
DOSE DISTRIBUTION IN SMALL TISSUE-EQUIVALENT VOLUMES
D. Srdoc *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 153–170 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

An experimental technique for measuring the energy deposition distribution in small tissue-equivalent volumes using the Rossi counter is described. The counter design, calibration, and gas multiplication are discussed. Aluminum and carbon K-lines were used for the energy calibration as well as for test of the counter resolution. Two tissue-equivalent gas mixtures, one containing methane and the other with propane, were investigated. The linearity of the counter response was carefully checked down to 0.277 keV. No significant departure from the linear relationship between the energy and the mean pulse height was observed at a low gas gain which indicated a constant energy per ion pair ratio. A substantial reduction of the preamplifier noise was achieved by incorporating the input stage of an FET charge sensitive preamplifier into the counter base. An operational amplifier with the logarithmic characteristic was included into electronics in order to convert the linear spectrum into the E(N)E vs log E spectrum. A number of energy deposition distributions were measured corresponding to 2, 1, 0.5, 0.25 and 0.125 micron tissue sphere using an external source of Co-60 gamma radiation. Author

N70-32386# Hammersmith Hospital, London (England). Medical Physics Dept.
WALL-LESS COUNTERS AND THE LINES OF THEIR FUTURE DEVELOPMENT
E. W. Emery *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 219–233 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

When a proportional counter is used to simulate a small tissue volume, the wall may introduce artifacts both from geometrical causes and possibly also through differences in the slow electron spectrum in gas and solid material of similar atomic composition. A wall-less counter avoids these difficulties but introduces uncertainties in the extent of the simulated volume. These various problems are examined. Conventional counters with walls will probably prove the more convenient instruments for the routine examination of radiation fields; but careful comparison with wall-less counters will be necessary to establish the corrections necessary for the wall effects. For the simulation of complex situations, such as the observation of simultaneous events in several associated microscopic volumes, wall-less offer wide scope, and it will be difficult to find substitutes for them. Author

N70-32387# Hammersmith Hospital, London (England). Medical Physics Dept.
PRELIMINARY MEASUREMENTS WITH A CYLINDRICAL WALL-LESS COUNTER
K. S. J. Wilson *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 235–248 ref (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The design of a cylindrical wall-less counter is described. The definition of the sensitive volume, and hence the working conditions of the counter are determined by the measurements of its saturation curves when irradiated with Co-60 gamma rays. Author

N70-32388# Columbia Univ., New York. Radiological Research Lab.
MICRODOSIMETRY OF DIRECTLY IONIZING PARTICLES WITH WALL-LESS PROPORTIONAL CENTERS
William Gross, B. J. Biavati, and H. H. Rossi *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 249–267 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The possible distortions of the pulse height spectra from walled proportional counters used for microdosimetric measurements due to the change in density of wall to gas have led to the development of counters with a minimum of wall material. Such wall-less counters have the additional advantage of making the measurement of spectra from directly ionizing particles possible. These spectra are remarkable primarily because of the large contribution from delta rays of directly ionizing particles which themselves do not enter the ionization volume. The contribution from these delta rays becomes more important as the simulated size becomes smaller. Alpha particle spectra for sizes down to 0.5 microns were obtained and a method to determine event spectra with small accelerator beams was developed. Author

N70-32389# European Atomic Energy Community, Ispra (Italy). Biology Service.
WALL EFFECTS OF SPHERICAL PROPORTIONAL COUNTERS

J. Oldenburg and J. Booz *In its* Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 269–281 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The spectral distribution of the energy transferred by monoenergetic neutrons to a spherical proportional counter of tissue equivalent material is calculated by a Monte Carlo program. This program considers all neutron reactions with the elements H, C, N, O, F, Si, and Ca which are energetically possible in the energy range of 6 MeV. By an analysis of all multiple events the following two types of wall effects are investigated: the increase in the average absorbed energy per primary neutron due to multiple scattering; and the increase in the average absorbed energy per primary neutron resulting from the simultaneous registration of two or more ionizing particles produced by a neutron reaction in the wall. Author

N70-32391# Columbia Univ., New York. Radiological Research Labs.
EXPERIMENTAL LIMITATIONS OF MICRODOSIMETRY
Harald H. Rossi *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 303–326 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

An examination of the objectives of microdosimetry indicates no fundamental experimental limitations except for a lower limit of the measurable energy deposition at the level of single gas ionization. It is shown that when considering energy deposition in an irradiated medium some lower limit of the energy transferred must be assumed if the concept is to be useful. The magnitude of this limit is not clearly established but there is some indication that the mean energy expended in a single ionization in a tissue equivalent gas mixture may be a suitable limit for radiobiological research. Author

N70-32392# Atomic Weapons Research Establishment, Aldermaston (England). Radiation Measurements Section.
DEVELOPMENT OF A LIGHTWEIGHT, ROBUST LET SPECTROMETER
B. Day *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 327–341 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The weight reduction is achieved by using a sealed system containing air instead of maintaining a flow of tissue equivalent gas. The vibration sensitivity was effectively eliminated by using shaped insulators instead of the helical wire to maintain the correct field distribution. The system has been operated in neutron fields of various energies and is shown to produce pulse size distributions which are identical to those produced by an unmodified Rossi counter in the same field. Author

N70-32393# Atomic Weapons Research Establishment, Aldermaston (England). Radiation Measurement Section.
A RECOMBINATION IONIZATION CHAMBER SYSTEM AS A SENSITIVE, THREE CHANNEL LET INDICATOR FOR STRATOSPHERIC USE
I. J. Wilson *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 343–362 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

In the development of the Concorde in-flight radiation warning meter, a system was required to indicate the different qualities of stratospheric radiation encountered at different altitudes during a single flight. As proportional counter LET spectrometers lack the necessary sensitivity, a system of three recombination ionization chambers was developed to operate in dose rates of 0.1-1 millirad/hr with a response time of a few minutes. The chambers are calibrated by collection efficiency measurements made with low LET (gamma), and medium LET (recoil proton) and high LET (internal alpha) radiations and three distinct polarizing voltages were selected for operational purposes. The chambers were used to measure the stratospheric radiation levels on ascent to and descent from 30,000 m during balloon flights. The three chamber system is to be compared with a transportable LET spectrometer in mixed radiations simulating stratospheric situations resulting from cosmic and solar flare protons interacting with the earth's atmosphere. Author

N70-32394# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Inst. fuer Strahlenbotanik.
DEVELOPMENT OF A COINCIDENCE-COUNTER TO MEASURE THE ABSORBED ENERGY INSIDE THE CELL FOR BETA-EMITTERS DEPOSITED IN THE CELL MEMBRANE
J. Handl and W. Kuehn *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 363–372 refs (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

Exchange processes and permeability problems of cell membranes are investigated by means of radioactive tracers which may result in an accumulation of radioactive materials inside the thin layers below the cell surface. Since the radiosensitivity of the interior parts of the cell nucleus is normally higher than that of the cell membrane it is necessary to know the burden of the cell volume due to the radioactive decay of nuclides deposited in a surrounding shell. This problem can be checked by experimental simulation in a special proportional counter device. The counter contains three concentric electrodes and is filled with tissue equivalent gas which can be labelled by H-3 or C-14. By coincidence electronics the fraction of particles can be selected which decays between the two outer electrodes and contributes to ionization between the interior electrodes. Spectrometric measurements are included. Author

N70-32395# Oak Ridge National Lab., Tenn. Health Physics Div.
MONTE CARLO METHOD OF DETERMINING LET SPECTRA FROM PULSE-HEIGHT MEASUREMENTS
J. E. Turner, R. D. Birkhoff, V. E. Anderson, H. A. Wright, E. B. Wagner et al *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 373 Sponsored by AEC (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The Monte Carlo method was used to calculate track length distributions in cavities of arbitrary shape placed in arbitrary fields of radiation. By utilizing these distributions the Monte Carlo technique was further applied to determination of LET spectra of radiation from pulse-height measurements made with energy-proportional detectors. In principle there are no physical restrictions on the applicability of this method of determining absorbed dose as a function of LET. Measurements made with spherical and cylindrical chambers irradiated by neutrons were analyzed and indicate that the Monte Carlo method can be applied for routine neutron monitoring. Author

N70-32396# Columbia Univ., New York. Radiological Research Lab.
ASSESSMENT OF DOSE EQUIVALENT FROM FLUCTUATIONS OF ENERGY DEPOSITION
L. Gunnar Bengtsson (Natl. Inst. of Radiation Protection) *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 375–400 refs (See N70-32376 17-04)
(Contract AT(301)-2740)
Avail: CFSTI HC$10.00/MF$0.65

Fluctuations in number and size of individual energy deposition events cause fluctuations in the total energy deposited in a small body repeatedly subjected to a constant radiation field during a fixed time. The variance (V) of the total energy deposition is

proportional to the dose average of the energy deposited in single events. V is also approximately proportional to the dose average quality factor, and measurement of V provides information on the dose equivalent. An instrument designed for the measurement of dose equivalent through measurement of V was built, using a tissue-equivalent gas proportional counter as the detector, and some preliminary tests are reported. The tests together with theoretical calculations suggest that the instrument could be used to measure the dose equivalent of neutrons in mixed fields to an accuracy of + or − 20%. The behaviour of the instrument at low neutron energies and in changing radiation fields is discussed. Author

N70-32399# Polytechnic, London (England). Dept. of Mathematics and Physics.

THE APPLICATION OF GENERAL CAVITY IONIZATION THEORY TO THE DOSIMETRY OF ELECTRON FIELDS

T. E. Burlin, R. J. Snelling, and B. Owen (Natl. Phys. Lab.) *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 455 − 478 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

An experimental examination of cavity theory was made with beta-ray sources irradiating an ionization chamber and also with electron beams from a linear accelerator irradiating a solid state dosimeter. In any situation where the electron spectrum is in a quasi-diffusion condition, the exponential treatment of the attentuation, previously used in general cavity theory, is valid. Author

N70-32410# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de la Protection Sanitaire.

TESTS OF SOME TECHNIQUES APPLICABLE TO THE MICRODOSIMETRY OF CHARGED PARTICLES [ESSAIS DE QUELQUES TECHNIQUES APPLICABLES A LA MICRODOSIMETRIE DE PARTICULES CHARGEES]

N. C. Parmentier, M. Chemtob, D. Chmelevsky, and J. C. Chianelli (Commissariat a l'Energie Atomique) *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 667 − 684 refs In FRENCH; ENGLISH summary (See N70-32376 17-40)

Avail: CFSTI HC$10.00/MF$0.65

Using a 10/micron diode it was attempted to obtain the spectra of the energies dissipated by proton beams varying between 10 and 20 MeV. The detectable energy loss varied from 80 to 50 keV. As predicted by theory, an increasingly asymmetric spectra was obtained towards high energies. These experimental results were compared with theory by means of a mathematical calculation. The purpose of this is to check experimentally the method of calculating dissipated energy spectra developed by A.M. Kellerer. Concurrently an attempt is made to define, by a calculation method, the shape of a wall-less proportional counter such that the collecting space is spherical. For this purpose a computer programme was used which can solve the Laplacian of the potential at every point in the collecting space. Author

N70-32425# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ILLUMINATING LENS INSERT FOR A STREAK CAMERA WITH ASYMMETRIC OBJECTIVES

A. S. Dubovik et al 13 Feb. 1970 6 p refs Transl. into ENGLISH from Zh. Nauch. i Priklad. Fot. i Kinematografii (Moscow), v. 11, no. 3, 1969 p 187 − 190

(AD-703552; FTD-HT-23-655-69) Avail: CFSTI CSCL 14/5

A lens insert was developed for the high speed streak camera with asymmetric objectives which guarantee a two fold increase in the physical illumination of the instrument compared with the existing version which has a two row lens insert. The remaining parameters of the camera are unchanged. Use of the lens insert simplifies and improves the work of a streak camera used together with shadow and interference units. Author (TAB)

N70-32500# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A DEVICE FOR MEASURING ELASTIC DEFORMATION OF NAVAL GAS TURBINE SHAFTS EXPOSED TO HIGH TEMPERATURES

V. I. Lokarev 24 Mar. 1970 13 p refs Transl. into ENGLISH from Sudostroyeniye i Morskiye Sooruzheniya (USSR), no. 8, 1968 p 48 − 52

(AD-704844; FTD-MT-24-386-69) Avail: CFSTI CSCL 14/2

There are a number of sensors for measuring elastic deformation of shafts (e.g., inductive, capacitive, magnetoelastic, pulse-position), but they are not for operation at high temperatures. A device for measuring turbine shaft elastic deformation at temperatures of 250-300 degrees centigrade has been developed, and the article discusses problems connected with the development of the device. The capacitive pulse generator is described, and the amplitude of its output signal is determined. TAB

N70-32558# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF MEASUREMENT OF TEMPORARY DAMPING OF OSCILLATORY PROCESSES IN STRUCTURES AND MECHANISMS

G. S. Lyubashevskiy et al 13 Oct. 1969 16 p refs Transl. into ENGLISH from the Publ. "Prikladnaya Akustika i Vibratsionnaya Tekhnika" Kiev, Naukova Dumka, 1968 p 84 − 91

(AD-700415; FTD-MT-24-228-69) Avail: CFSTI CSCL 13/13

One of the basic characteristics of oscillatory systems is the value of losses of oscillatory energy, determined by the speed of drop of oscillations with the stepwise turning off of exciting force. The measure of these losses in a system with one degree of freedom is usually the logarithmic damping decrement, the time constant of damping, and the Q-factor; in a system with many degree of freedom it is the time of reverberation, drop in level per unit of time and others. One of the simplest methods of determination of any of these values, interconnected at low losses by simple relationships, is determination of the time of assigned damping of the oscillatory process or decrease in its intensity for a fixed interval of time. In connection with this an instrument was developed allowing on the screen of the oscillograph with afterglow of the tube observing the process of damping of oscillations in a logarithmic scale of time and from the image directly determining the mean time constant of the envelope of the oscillatory process. Author (TAB)

N70-32611# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorbauelemente.

INDUCTIVE FLOWMETER AS PRIMARY ELEMENT FOR PARAMETER DETERMINATION IN A TWO PHASE FLOW [INDUKTIVE DURCHFLUSSMESSER ALS MESSWERTGEBER ZUR BESTIMMUNG DER PARAMETER EINER ZWEIPHASENSTROEMUNG]

Heinz Jonas May 1969 19 p refs In GERMAN; ENGLISH summary

(JUEL-595-RB) Avail: CFSTI

The use of inductive flowmeters for technical flow calculations in water cooled reactors is evaluated by determining their ability to measure the velocity and dimensions of forming bubbles as well as bubble changes during through flow. The measurement principle rests on Faraday's law which states that the motion of an electrical conductor in a vertical magnetic field induces an electromagnetic force. It is shown that bubble length and velocity can be measured with a high degree of accuracy and that the profile of deformed bubbles can be determined from length and the median diameters. Transl. by G.G.

N70-32626# Aerojet-General Corp., San Ramon, Calif. Nuclear Div.

DEVELOPMENT OF APPARATUS TO MEASURE VISCOSITY

OF GASES AND VAPORS. ALKALI METALS EVALUATION PROGRAM

P. Y. Achener Oct. 1969 65 p refs
(Contract AT(04-3)-368)
(AGN-8191-Vol-8) Avail: CFSTI

The device measures the damping of the transverse vibrations of a taut wire in the sample fluid. An absolute determination of viscosity is obtained from decay time and frequency data. The major components are a short length of tungsten-rhenium wire rigidly supported in tension within a strong electromagnetic field; an electromagnet; and readout instrumentation. A dc signal sets the wire in motion after which a fast-acting switch immediately disconnects the dc supply and connects the wire to an oscillograph. The wire, oscillating in the magnetic field, produces a voltage signal which is amplified and recorded on the oscillograph chart. Decay time is determined from the oscillograph trace. The oscillation frequency is measured simultaneously with an Eput meter. A prototype wire viscometer was constructed and operated with air and argon over the temperature range from 18 to 200 C. Results agree within 1% of accepted literature values. Author (NSA)

N70-32671*# Lockheed-Georgia Co., Marietta.
SPACE RADIATION HAZARDS TO PROJECT SKYLAB PHOTOGRAPHIC FILM Final Report

C. W. Hill, D. N. Davis, and J. H. Davis Jun. 1970 89 p refs
(Contract NAS8-24514)
(NASA-CR-61329; ER-10725) Avail: CFSTI CSCL 14E

A mathematical model of the Skylab Project cluster geometry is constructed. A radiation dose rate survey of the model is given for trapped protons, trapped electrons, and galactic cosmic radiation. The results of an analytical ATM film vault verification study are presented. Author

N70-32675# Commissariat a l'Energie Atomique, Grenoble (France). Lab. de Physique Nucleaire.
EFFICIENCY AND TIME RESOLUTION FOR LARGE Ge(Li) GAMMA DETECTORS USED IN FAST NEUTRON EXPERIMENTS

C. Sonrel, P. Perrin, M. Maurel, and A. Mougin 1969 21 p refs Presented at 14th Intern. Summer Meeting of Physicists, Duilovo, Yugoslavia, 8-20 Sep. 1969
(CEA-Conf-1432) Avail: AEC Depository Libraries

The intrinsic efficiency, energy and time resolution for the range of 5 to 17 MeV have been measured for some large (20 to 120 cu cm) Ge(Li) coaxial detector. The possibility of (n,gamma) and (n,ngamma) experiments has been checked using a multiparametric data system. Author (NSA)

N70-32709# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
RECORDING NOISE IN HOLOGRAPHY

G. W. Jull and K. O. Hill *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 12 p refs (See N70-32686 17-16)
(Contract DRB PCC-D48-28-01-07)
Avail: CFSTI

The origin, distribution and magnitude of photographic recording noise in holography are discussed. Three types of noise are distinguished. The first is intermodulation noise which arises due to the nonlinearity of the amplitude transmittance-exposure characteristics of the photographic emulsion. Its magnitude can be predicted using a theory for diffusely-illuminated objects recently reported. This shows that the magnitude is determined by the shape of the curve, the ratio of the reference to object beam intensity ratio, K, the bias transmittance, and the shape of the object. Observations on images from holograms made with Kodak 649F and Agfa-Gevaert 10E70 show that the intermodulation noise levels agree closely with the theoretical predictions. The second type of noise is surface relief noise which arises from the distortions of emulsion surface as a consequence of chemical processing. The 10E70 emulsion was found to produce higher surface relief noise than 649F emulsion. The final type of noise is film grain noise which arises from the granular nature of the photosensitive material. Calculations show that, for the small object used in these studies, the noise introduced by the film grains was less than that due to intermodulation noise. Author

N70-32716# Human Factors Research, Inc., Goleta, Calif.
THE ELASTIC SURFACE TRANSFORMATION

Robert J. Hall and Gene R. Kelley *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 10 p (See N70-32686 17-16)
Avail: CFSTI

The Elastic Surface Transformation (EST) is a new signal processing and display technique that permits the observer to manipulate and enhance marginal signals. The EST process consists of photographically transferring information from an electro-optical sensor to a uniformly prestretched surface. The surface is then allowed to contract in a continuous fashion to produce a uniform spatial compression of the prestretched surface. During contraction the size of elements on the surface remains constant, but the shrinking reduces their spatial dispersion, or increases the density of the elements per unit area. As the element density increases, the signal or image contrast also increases and the edges of the image are enhanced. The compressed imagery is then optically magnified to its original size. The effect on the image patterns are such that marked improvement occurs for the observer. The processing enables him to see information elements and to integrate them into image patterns at various stages of shrinking. Author

N70-32727# California Univ., Livermore. Lawrence Radiation Lab.
INSTRUMENTATION FOR THE OSO-4 CHARGED PARTICLE EXPERIMENT

James A. Waggoner, James L. Held, Wayne R. Higley, and Donald C. Peters 9 Sep. 1969 62 p refs Sponsored by AEC
(UCRL-50746) Avail: CFSTI

An instrument was designed, developed, constructed, tested, and calibrated for the investigation of the energy spectra and angular distributions of protons and electrons in the earth's magnetosphere from the OXO-4 satellite. The 33.3-lb instrument consisted of a single scintillator-photomultiplier assembly and associated electronics for identifying the type of incident radiation and its energy and angular distribution. Particle identification was accomplished by pulse-shape discrimination of the pulses produced by the stilbene scintillator. Differential energy spectra were accumulated in eight energy intervals for each particle type. Angular distributions were obtained in 16 interval of 22.5 deg each. Correlation of these angular distributions with the local magnetic field was made by utilizing a single-axis magnetometer incorporated in the satellite. A detailed description of the instrument, the principle of operation, selected circuit diagrams, testing, and calibration procedures are presented. Author (NSA)

N70-32733# California Inst. of Tech., Pasadena.
APPLICATION OF ION CYCLOTRON RESONANCE TO THE STUDY OF ION MOLECULE INTERACTIONS Technical Progress Report, 1 Apr. - 31 Dec. 1969

Jesse L. Beauchamp 31 Dec. 1969 33 p refs
(Contract AT(04-3)-767-8)
(CALT-767-P-8-X-1) Avail: CFSTI

The development of the ion cyclotron resonance spectrometer and the high-pressure mass spectrometer for studying ion-molecule reactions is outlined. Studies relating to nonreactive ion-neutral collision phenomena, reaction ion-neutral collision phenomena, and particle impact excitation phenomena are briefly discussed. NSA

N70-32745*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AUTOMATIC CALIBRATION SYSTEM FOR STRAIN-GAGE PRESSURE TRANSDUCERS
Marvin W. Tiefermann Washington Jul. 1970 11 p ref
(NASA-TM-X-2045; E-5647) Avail: CFSTI CSCL 14B

An automatic pressure calibration system in operation is described. Also presented is a typical testing program for complete evaluation of strain-gage pressure transducers. As many as 20 transducers can be calibrated at 75 F(297 K) in 7 min with pressure ranges from 1 to 2000 psi (0.7 to 1379 N/sq cm). The effects of temperature, overpressure, pressure cycling, and reference pressure (on differential transducers) can be measured and processed in a computer. System inaccuracy is less than 0.1 percent of full-scale output. Author

N70-32762# National Lead Co. of Ohio, Cincinnati. Technical Div.
A VERSATILE CONTROL PANEL FOR A PRODUCTION CONTROL QUANTOMETER
J. Kramer, M. R. Bailey, and D. G. Benge Mar. 1970 13 p
(Contract AT(30-1)-1156)
(NLCO-1053) Avail: CFSTI

A versatile control panel was designed and installed in a 2-meter production control quantometer (PCQ). This panel permits the separate programming of the pre-integration times, the integration times, and the voltages applied to the photomultiplier tubes through the attenuators assigned to individual elements for as many as three different sample groups of matrices. Once programmed, the group selector switch on the front of the PCQ recording console automatically selects the required program conditions for any one of the three different matrix methods. Author (NSA)

N70-32766# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
STRUCTURE OF THE GAS DISCHARGE IN THE PROPORTIONAL AND GEIGER ZONE FOR USE IN CHARPAK CHAMBERS [AUFBAU DER GASENTLADUNGEN IM PROPORTIONAL-UND GEIGERBEREICH ZUR ANWENDUNG IN CHARPAK-KAMMERN]
H.-J. Stuckenberg Dec. 1969 25 p refs In GERMAN
(DESY-69/49) Avail: AEC Depository Libraries

The gas discharge process of ionization chambers operating in the proportional and in the Geiger – Mueller regions is described. The discharge process is studied for both self-quenching gas fillings and non self-quenching gases. NSA

N70-32809# Atomic Energy Commission Research Establishment, Riso (Denmark).
A TIME OF FLIGHT SPECTROMETER WITH A FOURIER CHOPPER AND A POSITION SENSITIVE DETECTOR
Joergen Kjems Nov. 1969 9 p refs
(RISO-M-995) Avail: AEC Depository Libraries

The design of a time of flight instrument with sinusoidal modulated neutron intensity is described and examples of its performance are presented. The main components are a chopper with variable frequency, a position sensitive neutron detector, and a modified channel analyzer. NSA

N70-32886# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.
HOLOGRAPHIC CAMERA IN THE NANOSECOND RANGE
J. C. Buges and A. Terneaud 1969 14 p refs Presented at Gordon Res. Conf. on Laser Interaction with Matter, Issaquah, Wash., 25-29 Aug. 1969
(CEA-CONF-1459; CONF-690825-2) Avail: AEC Depository Libraries

A holographic camera in the nanosecond range is described. It is able to give a ten images sequence. The frame time is about 1.5 ns and the interframe time is 1 ns. This camera will be applied to plasma diagnostics. Author (NSA)

N70-32887# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ANALYSIS OF PULSE SPECTRA: THE CORAUT PROGRAM [DEPOUILLEMENT DE SPECTRES D'IMPULSIONS: PROGRAMME CORAUT]
Georges Manent Jan. 1970 55 p refs In FRENCH
(CEA-N-1238) Avail: AEC Depository Libraries

With this program, it is possible to analyze a pulse spectrum produced by a spectrometer under the following conditions: In a composite spectrum, the total absorption peak characteristic of the isotope is isolated and compared to that of a standard source. It is assumed that in the composite spectrum the peak is accompanied by a linear background noise. The linear noise is then defined around this peak. The program can compare the measured spectrum to the reference spectrum using a least squares method. It makes an automatic correction for the drift by resetting the reference with respect to the measurement using elementary operations equivalent to changes in the discrimination threshold (zero channel threshold) or to the spectrometer gain. Author (NSA)

N70-32890*# General Dynamics/Fort Worth, Tex. Nuclear Aerospace Research Facility.
DEVELOPMENT OF A SMALL INTEGRATING TISSUE EQUIVALENT QUARTZ FIBER ELECTROMETER DOSIMETER
C. S. Sims 15 Jun. 1970 94 p refs
(Contract NAS9-8752)
(NASA-CR-108527; FZK-370) Avail: CFSTI CSCL 06R

Theoretical considerations to point out trends in intrinsic behavior were formulated to aid in the design and sizing of the quartz fiber electrometer. Small automatic recycling quartz fiber electrometers were designed, developed, and constructed. Tissue equivalent ionization chambers for use with the quartz fiber electrometers were designed and built. The quartz fiber electrometer dosimeter systems, complete with the pulse shaping electronics, were tested to determine their applicability for use as space qualified radiation detection instruments. The performance of the dosimeters in the tests conducted (i.e. orientation, high and low dose rate Co-60 calibration, temperature, vibration and shock, and gas leak) indicates that they can indeed be developed into meritorious space qualified radiation dosimeters. Author

N70-32906# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SECONDARY EMISSION DETECTOR FOR THERMAL NEUTRONS [DETECTEUR DE NEUTRONS A EMISSION SECONDAIRE]
Robert Verdant Jan. 1970 45 p In FRENCH
(CEA-N-1264) Avail: AEC Depository Libraries

In this thermal neutron detector, the heavy particles coming from a (n,alpha) or (n,f) reaction in a given material (B or U), induce a secondary emission when crossing a target (Al) directly deposited on this material. The secondary electrons are detected through a classical electron multiplier. The influence of gamma radiation on the detector was tested; the highest permitted gamma radiation appears to be 1000 R/h. It was attempted to determine the suitable thicknesses of both the target and the converter for a given neutron flux. Such a detector could be placed, for instance, in the biological protection part of a reactor, where the temperature is lower than 100 C and the gamma radiation does not exceed a few hundreds of R/h. The influence of the emission of fission fragments on the residual pressure of the detector was studied. NSA

N70-32910# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF THE LIGHT EMISSION OF ELECTRON AVALANCHES IN BINARY MIXTURES ESSENTIALLY CONTAINING XENON. INTERPRETATION OF THE VISIBLE CONTINUUM EMITTED BY XENON [ETUDE DE L'EMISSION LUMINEUSE DES AVALANCHES ELECTRONIQUES DANS DES MELANGES BINAIRES CONTENANT ESSENTIELLEMENT DU XENON. ESSAI D'INTERPRETATION DU CONTINUUM VISIBLE EMIS PAR LE XENON]

J. P. Morucci and A. Lansiart 1970 22 p refs In FRENCH Presented at 12th Scintillation and Semiconductor Counter Symp., Washington, D.C., 11-13 Mar. 1970

(CEA-Conf-1480; Conf-700301-2) Avail: AEC Depository Libraries

The spectral distribution of an electron avalanche for different binary mixtures (xenon + methylal or methane or diethyl amine) was studied at atmospheric pressure. A continuum spectrum is obtained, on which lines are superimposed. These lines disappear as the ionizing potential of the vapor decreases but the visible continuum, which constitutes the main part of the light, remains constant. Therefore, the emission mechanism of the visible light emitted by xenon was studied. An important emission of visible light takes place even when there is no xenon excited state. Only the direct electron-xenon molecule interaction can explain this phenomenon and leads to the introduction of the molecular ion Xe2(-) NSA

N70-32922# Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany).

LARGE VOLUME SCINTILLATION CHAMBER FOR THE MEASUREMENT OF RADON CONCENTRATIONS

W. Schlueter Oct. 1969 24 p refs In GERMAN

(SZS-11/69) Avail: AEC Depository Libraries

A method for measuring the radon content of air is described. The detector is a 2.8 l volume spherical chamber covered internally with ZnS(Ag) and viewed by a 60 mm photomultiplier tube. The counting efficiency for radon in equilibrium with its two alpha-emitting daughters is 20%. The minimum detectable activity amounts to 5 × 10 to the minus 14th power Ci/l. Author (NSA)

N70-32925# Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany).

MEASUREMENT OF LOW-ENERGY BETA EMITTERS WITH A SIMPLE LIQUID SCINTILLATION COUNTER

R. Buschmann and K.-F. Poulheim Aug. 1969 28 p refs In GERMAN

(SZS-8/69) Avail: AEC Depository Libraries

A simple liquid scintillation counter is described which is used for routine measurements of low-energy beta emitters. The apparatus is only suitable for measurements of small sample members. The average efficiency and the minimum detectable activities are given for the nuclides Pm-147, S-35, C-14, and Ni-63. Author (NSA)

N70-32978# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

PERFORMANCE OF NEUTRON DETECTORS DEVELOPED IN FRANCE FOR REACTOR CONTROL [QUELQUES PERFORMANCES DES DETECTEURS DE NEUTRONS DEVELOPPES EN FRANCE POUR LE CONTROLE DES REACTEURS]

E. Bacconnet, R. Comte, and J. Duchene Oct. 1969 29 p refs In FRENCH Presented at Symp. on the Performance of Nucl. Power Reactor Components, Prague, 10-14 Nov. 1969

(CEA-Conf-1454; Conf-691115-1) Avail: CFSTI

The neutronics instrumentation which is used in the control systems at reactor centers is discussed. The characteristics of the fission chambers, BF3 counters, and associated electronics are outlined. Calibration and dead time measurements are described; data are presented in tabular and graphic form. Time, high temperature, and high flux response of the fission chambers and BF3 detectors are discussed; results of measurements are given. The development of high temperature and high flux cables for the in-core instrumentation is discussed. NSA

N70-32988# Battelle-Northwest, Richland, Wash.

EVALUATION PROGRAM FOR PORTABLE RADIATION MONITORING INSTRUMENTS

L. V. Zuerner and R. L. Kathren Dec. 1968 23 p Presented at Health Phys. Soc. Midyear Topical Symp., Los Angeles, 29-31 Jan. 1969

(Contract AT(45-1)-1830)

(BNWL-SA-1947; Conf-690103-20) Avail: CFSTI

A well oriented and directed evaluation program for radiological measuring devices for health physics purposes should examine appropriate physical, electronic, and radiological characteristics of the instrument providing data for performance and cost analysis. For portable instruments, weight, strength, and ease of handling and servicing are important physical characteristics. Human engineering features such as ease of meter reading, availability of controls, and physical stability must also be considered. Among the electronic features to be considered are sensitivity, temperature and voltage dependence, stability, battery lifetime, response to electrical interference, noise and vibration, and extracameral radiation. Radiological factors include accuracy and stability of calibration, energy dependence, response to unwanted radiations, temperature dependence, and saturation effects. A typical evaluation program is outlined for portable radiation survey meters and recommendations made for a standardized system of determining and reporting instrument performance. Author (NSA)

N70-32998# California Univ., Livermore. Lawrence Radiation Lab.

SPECTRUM DEGRADATION EFFECTS IN Ge(Li) DETECTORS

G. A. Armantrout and H. W. Thompson, Jr. (Purdue Univ.) Mar. 1970 24 p refs Presented at 12th Scintillation and Semiconductor Counter Symp., Washington, D.C., 11-13 Mar. 1970

Sponsored by AEC

(UCRL-72109; Conf-700301-6) Avail: CFSTI

The mechanisms responsible for the degradation of the performance of Ge(Li) detectors (which include the effects of uniform trapping, nonuniform trap distribution, and locally weak collection fields) are considered, and simulated spectra were computed. Experimental measurement were made to identify these sources of degradation. The important results include a measurement of the effective capture cross sections of the most important traps and a determination of the main sources of nonuniform trap distribution and weak collection fields in Ge(Li) detectors. Author (NSA)

N70-33043# Tennessee Univ., Knoxville.

CONSTRUCTION AND USE OF A HIGH RESOLUTION PHOTOELECTRON SPECTROMETER

Bailey Price Pullen (Ph.D. Thesis) Mar. 1970 117 p refs Sponsored by AEC

(TID-25381) Avail: CFSTI

A He discharge lamp which emits primarily 21.22 eV photons in conjunction with an electrostatic deflection type electron spectrometer has been constructed for irradiating compounds and then submitting the ejected photoelectrons to energy analysis. For this energy analysis, the photoelectrons are allowed to pass through two small slits into the region between two spherical sector plates held at a predetermined voltage difference. Photoelectrons of a given energy then emerge through two exit slits, the outer one

positioned 180 deg from the first entrance slit, where they are detected by an electron multiplier. The photoelectron spectra of CO, CH4, SiH4, GeH4, CH3F, Ch2F2, CHF3, BF3, BCl3, SF6, NF3, CF4, SiF4, Ch3Cl, and CF3Cl are presented. NSA

N70-33052# Uppsala Univ. (Sweden). Inst. of Physics.
ON THE EVALUATION OF RELIABLE PARAMETERS FOR THE DESCRIPTION AND DESIGN OF FLAT SPECTROMETERS
T. Groth Nov. 1969 43 p refs
(UUIP-663) Avail: AEC Depository Libraries

Flat spectrometers are customarily described by the radial variation of the field intensity in the plane of symmetry. The usefulness of expansion coefficients a sub n in the design of a spectrometer is highly dependent on the reliability of these coefficients as descriptive parameters. The successful application of Chebyshev approximation methods to the problem of evaluating reliability coefficients is reported and the shortcomings of commonly used standard procedures are also pointed out. The methods are applied to the optimum field giving 12 expansion coefficients, the first seven of which coincide with those theoretically derived by Lee-Whiting and Taylor. Author (NSA)

N70-33054# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PULSE PILE-UP FOR A PRECISION AMPLITUDE SPECTROMETER WITH R C-FILTERS
V. A. Antyukhov and B. Yu. Semenov 1970 16 p refs In RUSSIAN
(JINR-P13-4979) Avail: AEC Depository Libraries

A device for generating a signal for blocking the triggering of the amplitude analyzer in the case of pile-up events (the pile-up inspector) is described. The performance requirements are considered, the functional and principal circuits are given, and the results of experiments are discussed. The logarithmic dependence of the blocking pulse duration upon the input signal amplitude, the absence of the self-dead time, a wide dynamic range of input signals (up to 1000), and the conservation of the performance characteristics at high counting rates provided a high efficiency for applying the inspector to the precision spectrometer channel when pulses are shaped with RC-filters. Author (NSA)

N70-33058*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
AN ELEMENTARY ANALYSIS OF THE ADAPTATION OF THE BEAMS' EXPERIMENTAL CONCEPT TO A DELTA G/G DETECTOR TO BE USED IN SPACE
B. E. Blood Jun. 1970 39 p refs
(Contract NAS9-8328)
(NASA-CR-108526; RN-60) Avail: CFSTI CSCL 14B

Presented is an elementary analysis for an experimental apparatus. In order to detect changes in the gravitational attraction between two or more test bodies, the experiment uses inertial angular acceleration as a balance torque. General relativity predicts a different value for the Newtonian gravitational constant in regions of different gravitational potential. This difference is very small for gravity fields of objects in the solar system. Discussed are the problems associated with adpating an experimental concept to an apparatus that can be used in spacecraft orbits to regions of different gavitational potential. The chief results are: (1) establishment of an idea of the size (and mass) of the experiment; and (2) isolation of problems to be considered in subsequent analyses. Author

N70-33071*# California Inst. of Tech., Pasadena. Seismological Lab.
DEVELOPMENT OF PERFORMANCE CRITERIA AND FUNCTIONAL SPECIFICATIONS FOR A PASSIVE SEISMIC EXPERIMENT ON MARS Final Report
Don L. Anderson, Wayne F. Miller, and Francis E. Lehner 31 Dec. 1969 85 p
(Grant NGR-05-002-129)
(NASA-CR-110647) Avail: CFSTI CSCL 17J

Various design models of the Viking seismometer were constructed and tested for period, damping, generator constant, tilt sensitivity, etc. A vertical unit was operated successfully over the temperature range of −110 to +80 C. Results of shake table and calibration system tests show the detector's ability to perform as desired in the projected capacity. G.G.

N70-33101# Lockheed Missiles and Space Co., Palo Alto, Calif.
SIMULATOR OF INFRARED CLOUDY SKY BACKGROUNDS TO INVESTIGATE INTERFERENCE IMMUNITY OF ELECTRO-OPTICAL AUTOMATIC REGULATION SYSTEMS
K. K. Denshchikov [1970] 6 p refs Transl. into ENGLISH from Izv. Vysshikh. Uchebn. Zavedenii Priborostr. (Leningrad), no. 10, 1969 p 38–42
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

An informative model based on a set of interchangeable diapositives is used to simulate infrared sky backgrounds. A two-dimensional random function was taken as the model of the natural infrared background and was constructed according to a given algorithm. The number of diapositives is calculated by methods of mathematical statistics from conditions of Poisson distribution law. R.B.

N70-33103*# Honeywell, Inc., Lexington, Mass. Radiation Center.
SYSTEM DESIGN STUDY FOR AN OPTIMAL REMOTE OCULOMETER FOR USE IN OPERATIONAL AIRCRAFT
John Merchant, Ronald Wilson, and Kenneth A. Mason Washington NASA Jul. 1970 198 p refs
(Contracts NASw-1159; NAS12-531)
(NASA-CR-1562) Avail: CFSTI CSCL 17H

The results are presented of a design study for a remote configuration oculometer suitable for measuring the eye direction of a pilot, without causing any interference to his normal activities. The principle feature of the oculometer is the utilization of a method which does not require that the device be clamped, or otherwise fixed to the subject. The material presented includes an analysis of the basic design factors, system descriptions, and a performance summary. D.L.G.

N70-33114# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DEVICE FOR INVESTIGATING AND CHECKING THE MAGNETIC MEMORY ELEMENTS OF THIN-FILM MATRICES
A. D. Bekh et al 19 Mar. 1970 13 p Transl. into ENGLISH from Mekhaniz. Avtomatiz. Upr. (USSR), no. 6, 1967 p 28–31
(AD-704855; FTD-MT-24-26-70) Avail: CFSTI CSCL 14/2

A tester has been developed for the quality control of batch-produced memory matrices. Both the thin film and the system of wires are tested. The matrix under test has 36 18-digit words on a 50 x 50-mm backing; first, the matrices are rated, then grouped according to their close ratings, and then tested; this procedure reduces the number of rejects. The minimal sensing signal, minimal write signal, and maximum destruction signal are measured; the latter signal is measured after the information has been written into the test cell by a single pulse while the adjacent elements receive equal pulses of reverse polarity. The tester permits measuring the three above parameters simultaneously in all elements of one digit (place) of the test matrix. The tester (a block diagram shown) is designed with standard thin-film-memory elements. TAB

N70-33129# Naval Postgraduate School, Monterey, Calif. Dept. of Physics.
SUPERCONDUCTING DETECTOR OF NUCLEAR PARTICLES
Donald Edward Spiel (M.S. Thesis) Oct. 1969 51 p refs Sponsored in part by Army
(AD-704523) Avail: CFSTI CSCL 18/4

The response of thin, superconducting films of tin and of indium to alpha particle bombardment has been studied. The films were sufficiently thin and narrow that individual alpha particle impacts initiated superconducting to normal transitions across a full film cross section. The transitions were observed by means of the IR drop produced by a transport current. For low current densities, self-terminating voltage pulses of a few nanoseconds duration were observed. At higher current densities, a normal region initiated by an alpha particle propagated, by Joule heating, to the ends of the film. The alpha-particle range exceeded the thickness of the films and the energy deposited in the substrate by an alpha traversal affected the response of any film in direct contact with its substrate. Thin, thermally insulating films introduced between the detectors and their substrates, however, effectively isolated the detectors. The variation of count rate with film current was studied and is shown to be consistent with the variation of critical current density along the length of the film. A heat diffusion model accounts for the observed behavior of the thermally isolated films. Author (TAB)

N70-33144# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
GAMMA RAY COMPENSATED GERMANIUM DETECTORS
E. M. Lawson Dec. 1969 14 p refs
(AAEC/TM-527) Avail: AEC Depository Libraries

The characteristics of gamma ray compensated germanium detectors are described. The stability of the radiation defects enables the spectrometers to be stored at room temperature. Detector resolution and efficiency and the procedure for constructing the detectors are described. Author (NSA)

N70-33179* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANGULAR MEASUREMENT SYSTEM Patent
Robert J. Schwinghamer and John R. Rasquin, inventors (to NASA) Issued 26 Jun. 1962 (Filed 28 Aug. 1961) 5 p Cl. 340-198
(NASA-Case-XMF-00447; US-Patent-3, 041, 587; US-Patent-Appl-SN-134479) Avail: US Patent Office CSCL 14B

A simplified type of angular indicating and measuring system is described. In the proposed system, the angular rotation to be monitored is coupled to a means for translating the rotation into separate electrical output signals representative of the sine and cosine of the angular rotation from a reference position. The system includes a means for sensing when rotation reaches or passes 45, 135, 225, and 315 degrees. The sensors then energize switches which would selectively provide either a sine or cosine output in accordance with the predetermined schedules. The indication, which is electrical, may be used to control angular positioning equipment or as a visual indication of position. P.N.F.

N70-33252# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
LAST DEVELOPMENTS ON SPARK CHAMBERS [DERNIERS DEVELOPPEMENTS SUR LES CHAMBRES A ETINCELLES]
A. Lansiart, J. P. Morucci, G. Allard, and A. Seigneur 1970 11 p in FRENCH Presented at the 9th Intern. Symp. on Clinical Res. in Radioactive Isotopes and in Biol., Bad Gastein, Austria, 12-15 Jan. 1970
(CEA-Conf-1486; Conf-700109-1) Avail: AEC Depository Libraries

Three recent developments in spark chambers are described. These are glasses having a deposit of tin oxide on each face, the use of a Be cathode and a 2 mm detection space for small-angle x-ray diffraction, and association of a collimator with spark chambers. The results obtained from each of these developments are described. NSA

N70-33254* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOTION PICTURE CAMERA FOR OPTICAL PYROMETRY Patent
Herbert Kurt Strass, inventor (to NASA) Issued 3 Jul. 1962 (Filed 18 Nov. 1959) 6 p Cl. 88-16
(NASA-Case-XLA-00062; US-Patent-3, 041, 924; US-Patent-Appl-SN-853983) Avail: US Patent Office CSCL 14E

A filter arrangement used in combination with the lens system of a photographic camera is described for application in optical pyrometry. A pair of superimposed filter discs are arranged to cover the lens element, which uniformly varies the intensity of admitted light. R.B.

N70-33263# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONNECTIONS TO BE USED BETWEEN PRINCIPAL DETECTORS OF IONIZING RADIATIONS AND THEIR ELECTRONIC INSTRUMENTS
Roger Lefevre and Henri Roquefort Feb. 1970 40 p refs In FRENCH
(CEA-N-1281) Avail: AEC Depository Libraries

The most important input and output connections, connectors and cables that link detectors of ionizing radiation with their associated electronic instruments are described. As a guide for the user, a list of standard connectors and cables for every kind of instruments is given. Preferred connections to be used for each particular case are indicated. In addition, several examples of connections between detectors and apparatus, connector types and their associated cables, and various configurations of ground and earth circuits are given. NSA

N70-33275# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.
RESEARCH ON SURFACE CATALYSIS IN NONEQUILIBRIUM FLOWS Final Report, Sep. 1967 - Sep. 1969
John A. Bartz and Robert J. Vidal Arnold AF Sta., Tenn. AEDC Apr. 1970 62 p refs
(Contracts F40600-68-C-0001; F40600-69-C-0005)
(AD-704814; CAL-AF-2753-A-2; AEDC-TR-70-111) Avail: CFSTI CSCL 14/2

The report describes the results of a program of research to develop a catalytic probe with a discontinuous catalytic surface. The ultimate objective is to use the probe to measure the ambient oxygen atom concentrations in high-temperature wind tunnel facilities, and a discontinuous catalytic surface was used to increase the probe sensitivity to small atom concentrations. The report first reviews the theoretical basis for this probe configuration, and then presents experimental data obtained with the probe in air and simulated air. The accuracy of existing theory for a probe with a discontinuous catalytic surface was demonstrated in equilibrium flow experiments in a shock tube using simulated air with a single reactant. SSubsequent equilibrium flow experiments in real air indicated that oxygen atom recombination is the only important reaction occurring on the surface and thereby demonstrated the utility of the probe as a diagnostic in high-temperature air flows. It was concluded that the discrepancies could result from a weak wave system in the nozzle and from uncertainties in the chemical rate data used in the theoretical prediction of the nozzle flow. Author (TAB)

N70-33321# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF A RADIATION THERMOCELL WITH NONDISTRIBUTED DETECTION AREA
V. P. Kozyrev [1970] 4 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 4, 1970 p 101 - 104
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A general type of multijunction system for a radiation thermocell with nondistributed detection area is discussed. Formulas are derived for calculating heat losses due to radiation and radiation losses from the cell surface. R.B.

N70-33322* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PARTICLE DETECTION APPARATUS Patent
William H. Kinard, inventor (to NASA) Issued 17 Oct. 1961 (Filed 21 Dec. 1959) 3 p Cl. 244-14
(NASA-Case-XLA-00135; US-Patent-3,004,735; US-Patent-Appl-SN-861152) Avail: US Patent Office CSCL 14B

A particle detector is described for indicating the frequency of incidence and energy of minute space particles by using a towable aerospace target selectively responsive to the impingement. The device consists of an erectable sail composed of multiple layers of electrically conducting and insulating materials, a common source of potential energy, a common indicator and an electrical impedance individually coupling each of the conductive layers to the energy source and indicator. F.O.S.

N70-33336# Institute of Nuclear Research, Warsaw (Poland).
COAXIAL GERMANIUM DETECTORS OF GAMMA RADIATION
Ya. Khvashchevska, Ya. Yurkovski, M. Shimchak, and K. Skochek 1969 14 p refs In RUSSIAN; ENGLISH summary
(INR-P-1161) Avail: AEC Depository Libraries

Coaxial Ge(Li) detectors having active volumes of 2 to 10 cu cm and resolutions of 1.9 keV for 122 keV gamma radiation (Co-57) and 2.7 keV for 662 keV gamma radiation (Cs-137) were fabricated. Preamplifiers for these detectors and the vacuum chamber for the operation at low temperatures (N2) have been constructed. Author (NSA)

N70-33353# Bureau of Mines, Amarillo, Tex. Helium Research Center.
METHOD OF WEIGHING AN OBJECT IN GASEOUS ATMOSPHERES TO OBTAIN ITS TRUE MASS AND VOLUME
Alexander May and Robert E. Barieau Jul. 1970 35 p refs
(BM-RI-7413) Avail: Issuing Activity

A method of weighing based upon observing the apparent weight of an object in two separate gases is described. The method is presented in terms of experimental data which prove its soundness, but does not attempt to show the maximum accuracy possible with this technique. The method incorporates the underlying principle that the apparent weight of an object is a linear function of the density of the atmosphere in which the object is weighed. The coefficients of this linear function are the true mass and volume of the object. Author

N70-33354# Instituto Politecnico Nacional, Mexico City. Escuela Superior de Ingenieria Mecanica y Electrica.
DESIGN AND CONSTRUCTION OF AN AMPLIFIER FOR SIGNALS ORIGINATING IN A GAS IONIZATION DETECTOR
Jose Luis Martinez Robles 1969 48 p In SPANISH
(NP-18177) Avail: AEC Depository Libraries

The characteristics of the principal gas ionization detectors including ionization chambers, proportional counters, and G-M detectors are outlined. The conditions which an amplifier to be used with these detectors must satisfy are considered from the viewpoint of the pulse-height analyzer, input circuit, linearity of the amplifier, noise, simple RC differentiation, and accumulation and superposition effects. The design of an amplifier is described in detail with a description of the separator stage, amplifier stage, adjustment stage, differentiator cirucit, and polarization circuit of the detector. The experimental results on the characteristics of the amplifier constructed are reported and show that the amplifier is suitable for amplification of signals originating in a gas ionization chamber. NSA

N70-33384# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
TEST OF SEVERAL TECHNIQUES APPLICABLE TO MICRODOSIMETRY OF CHARGED PARTICLES [ESSAIS DE QUELQUES TECHNIQUES APPLICABLES A LA MICRODOSIMETRIE DE PARTICULES CHARGEES]
N. C. Parmentier, M. Chemtob, D. Chmelevsky, and J. C. Chianelli (CEA, Saclay) 1969 20 p refs in FRENCH Presented at 2d Symp. on Microdosimetry, Ispra, Italy, 20-24 Oct. 1969
(CEA-Conf-1444; Conf-691012-2) Avail: AEC Depository Libraries

It was established that each time it is necessary to explain the action of radiations on the biological medium, it was necessary to reduce the scale examined. The present study has the object of predicting in the microscopic volumes the form of the energies dissipated. The experimental difficulties of detection in thin solid media do not permit, in the present state of the technique, operation on very thin surfaces nor on dissipated energies below several tens of keV. Design is proceding on a wall-less spherical proportional counter which it is hoped will make it possible to descend to equivalent-tissue thickness and to measure dissipated energies at least equal to 30 eV by profiting from the multiplication. Author (NSA)

N70-33386* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIR FRAME DRAG BALANCE Patent
Abraham Leiss, Joseph H. Judd, and Robert S. Freeman, inventors (to NASA) Issued 26 Sep. 1961 (Filed 15 Jan. 1960) 6 p Cl. 73-147
(NASA-Case-XLA-00113; US-Patent-3,001,395; US-Patent-Appl-SN-2792) Avail: US Patent Office CSCL 14B

A device is described for use in flight tests for measuring drag forces acting upon an aerial vehicle moving through the atmosphere. It is designed to give a complete history of the drag forces acting on the model during the entire flight by transmitting data to a remote receiving and recording station. F.O.S.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-32006*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEPOSITION OF ALLOY FILMS ON COMPLEX SURFACES BY ION PLATING WITH FLASH EVAPORATION
Talivaldis Spalvins Jun. 1970 8 p refs
(NASA-TM-X-52823) Avail: CFSTI CSCL 13H

A method is described which basically incorporates a combination of two independent methods: (1) ion plating, and (2)

flash evaporation. This ion plating with flash evaporation (IPFE) method can be used to deposit alloy films without a change in composition. Three alloys of the following weight percentages were deposited: Pb-Sn (50-50), Pb-Sn (34-65) and Cu-Au (85-15). These alloy films were analyzed quantitatively and the original composition was maintained. These films can be deposited on complex surfaces on a stationary specimen. Exceptionally strong adherence is obtained between the film and the surface. A graded interface is formed due to the high penetrating effect of the plating material. Author

N70-32010*# Hughes Research Labs., Malibu, Calif.
IONIZER SURFACE PROTECTION TECHNIQUES
C. R. Dulgeroff and D. E. Zuccaro Mar. 1970 73 p refs
(Contract NAS3-11527)
(NASA-CR-72730) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 13H

A technique for applying a metallic coating to the surface of a porous tungsten ionizer of an ion thruster was developed. The effect of a silver coating on the flow characteristics of the ionizer was investigated. The technique was used on an operable ion engine and the effectiveness of the coating evaluated. A coating of 50 to 100 A of silver did not provide the degree of protection desired. Author

N70-32037# Defense Documentation Center, Alexandria, Va.
ADHESIVE BONDING, VOLUME 1A DDC BIBLIOGRAPHY, NOV. 1945 – MAR. 1969
Apr. 1970 141 p refs
(AD-704525; DDC-TAS-70-34-1) Avail: CFSTI CSCL 13/8

The bibliography contains 100 selected unclassified annotated references on Adhesion Bonding. These references pertain to bonding of metals, stainless steel, composite materials, and crystals. The techniques and effectiveness of manufacturing methods, process development and quality control of sealing compounds and adhesives for bonding are discussed. Corporate author-monitoring agency, subject, and personal author indexes are included. Author (TAB)

N70-32134# Defense Documentation Center, Alexandria, Va.
VAPOR PLATING, VOLUME 1 Report Bibliography, Oct. 1960 – Jun. 1969
Apr. 1970 115 p refs
(AD-704450; DDC-TAS-70-24-1) Avail: CFSTI CSCL 13/8

The bibliography contains 79 selected unclassified and unlimited annotated references on vapor plating. These references pertain to metal films, thin films, semiconducting films, metal coatings, crystal growth, refractory materials, process development, manufacturing methods, and research and development of the vapor plating techniques. Corporate author-monitoring agency, subject, and personal author indexes are included. Author (TAB)

N70-32135# Brown Univ., Providence, R.I. Div. of Engineering.
AN ELECTRON-MICROSCOPIAL STUDY OF THE TEMPERING OF TUNGSTEN-HIGH SPEED STEELS
Erdogan Tekin (Middle East Tech. Univ.) and Marc H. Richman Mar. 1970 14 p refs
(Contract ARPA SD-86)
(AD-704479; ARPA-E71) Avail: CFSTI CSCL 11/6

An investigation into the tempering process of tungsten high speed tool steels has been carried out using optical and electron microscopy. The secondary hardening phenomenon in these steels is caused mainly by the precipitation of W2C carbides. M23C6 carbide also appears at and above 550C but does not play a major role in secondary hardening. Author (TAB)

N70-32265# Franklin Inst., Philadelphia, Pa. Research Labs.
SURVEY OF THE STATE-OF-THE-ART FOR THE DESIGN OF HIGH SPEED ROLLING ELEMENT BEARINGS USED IN GAS TURBINE ENGINES: VOLUME 1 Final Report
John H. Raumberger and James D. Dunfee Mary 1969 55 p
(Contract N00156-68-C-0330)
(AD-705127; F-C2138-Vol-1) Avail: CFSTI CSCL 13/9

The state-of-the-art for the design of high-speed rolling element bearings used for gas turbine engine mainshafts is reviewed. Recommendations are made for research and development needed to satisfy future U. S. Navy requirements especially pertaining to rolling element bearing technology. Six American engine manufacturers were visited and contributed to the review. The survey report, Volume I, includes design criteria, design theory, materials, and performance parameters pertaining to bearing design for engines over the past ten years and those currently in design. Author (TAB)

N70-32266# Franklin Inst., Philadelphia, Pa. Research Labs.
SURVEY OF THE STATE-OF-THE-ART FOR THE DESIGN OF HIGH SPEED ROLLING ELEMENT BEARINGS USED IN GAS TURBINE ENGINES. VOLUME 2: LITERATURE REVIEW Final Report
John H. Rumbarger and James D. Dunfee Feb. 1969 71 p refs
(Contract N00156-68-C-0330)
(AD-705128; F-C2138-1-Vol-2) Avail: CFSTI CSCL 13/9

This volume II of the final report contains a comprehensive listing of published work in rolling element bearing technology related to gas turbine mainshaft bearing design from the years 1950 through 1968. Also included are some classical theory and analysis papers dating back to 1901. For convenience in locating a reference, the citations (with abstract when available) are arranged into nine categories designated index code A through I. Under each index, the author(s) name is listed first chronologically by year of publication, and then alphabetically in each year. An author index, with cross reference to the citations with abstracts is also included. Author (TAB)

N70-32423# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON AUTOMATING TURBINE BLADE FINISHING
B. A. Milyukhin 5 Sep. 1969 12 p Transl. into ENGLISH from Priborostroenie (URSR) no. 3, 1967 p 135 – 139
(AD-701985; FTD-MT-24-141-69) Avail: CFSTI CSCL 13/8

Since conventional automation methods cannot be used for turbine-blade manufacture because these blades are produced in small lots, programmed finishing should be used in their manufacture. In this connection, a stand was designed consisting of a turn table, to which the mock-up blade-profile section is fastened, and a measuring feeler. On turning the mock-up, e.g., through 1.5 degree intervals, it pushes the measuring feeler a certain distance which is recorded, and the recorded values may be then used for programming the operation of the programmed-finishing machine tool. A method was developed for the experimental determination of the relative displacements of the finishing instrument and the part being machined. The mathematical expression for the curve representing the displacement of the junction point between the blade being machined and the machining instrument is a difficult problem. However, in the case of an arc of a circle, e.g., for a concave surface, the displacement of the finishing instrument can be expressed analytically using trigonometric functions. Author (TAB)

N70-32442# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SURFACE QUALITY IN TURNING HEAT-RESISTANT MATERIALS

F. P. Uryvskiy et al 11 Mar. 1970 18 p refs Transl. into ENGLISH from Tr. Kuybyshev Aviats. Inst. (Kuybyshev), no. 20, 1965 p 183–174
(AD-704849; FTD-MT-24-430-69) Avail: CFSTI CSCL 11/6

A presentation is made of the results of a study of the cold hardening and residual stresses occurring with the turning of titanium alloys VTZ-1, VT14, and with heat resistant steel EI787. An effort is also made to describe certain phenomena resulting from the relationship of the temperature in the cutting zone and the residual stresses. Measurements were made of the effect of the type of cutting, instrument wear, and forward angle on the thickness of the cold-hardened layer, and as the result of these measurements a range is established for the intensity and depth of cold-hardening. Data on residual stresses point out that in turning EI787 steel tensile stresses develop in the upper layers of the material, while the residual stresses in the titanium alloys VTZ-1 and VT14 prove to be compressive. Quantitative estimates of the residual stresses are developed for each type of material. Some analysis is made of the relationship of the materials fatigue properties and the residual stress values. Author (TAB)

N70-32445# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF MATERIAL AND CHEMICAL-HEAT TREATMENT OF GEARS ON THEIR SUPPORTING POWER AND LIFE
A. I. Korablev et al 6 Mar. 1970 43 p Transl. into ENGLISH from the book 'Povysheniye Nesushchey Sposobnosti i Dolgovechnosti Zubchatykh Peredach' USSR, 1968 p 73–102
(AD-704772; FTD-MT-24-416-69) Avail: CFSTI CSCL 13/9

The article contains material concerning the effect of material and chemical-heat treatment of gears on their supporting power and life. Some of the items discussed are steel gears and selection of methods of their heat and chemical-heat treatment; volume hardening of gears, carburization and case-hardening of gears with martempering, effect of chemical composition of steel on the supporting power of case-hardened and hardened gears, effect of properties of the case-hardened layer and core on supporting power, effect of thickness of case-hardened layer on supporting power, nitriding gears, cyaniding and carbonitriding gears, surface hardening of gear teeth, materials used for manufacture of gears, etc. Author (TAB)

N70-32447# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACADEMY OF SCIENCES OF THE USSR. STATE SCIENTIFIC RESEARCH INSTITUTE OF MACHINE SCIENCE (SELECTED ARTICLES)
L. F. Vasilkovskii et al 9 Oct. 1969 18 p refs Transl. into ENGLISH from the publ. "Akademiya Nauk SSSR. Gosudarstvennyy Nauchno-issledovaatelskiy Institut Mashinovedeniya" Moscow, Izd-Vo Nauka, 1967 p 167–172
(AD-700406; FTD-24-230-69) Avail: CFSTI CSCL 13/8

Contents: An automatic rotary device for the manufacture of castings with crystallization under pressure; and Continuous underwater pouring of aluminum. TAB

N70-32457 National Lending Library for Science and Technology, Boston Spa, (England).
BRAKE LININGS AND FRICTION COUPLING LININGS AND ATTACHMENTS [BREMSBELAEGE UND BELAEGE VON REIBUNGSKUPPLUNGEN SOWIE DEREN BEFESTIGUNGEN]
Nov. 1969 15 p refs Transl. into ENGLISH from Dortmund Mines Inspectorate, publ.
(NLL-SMRE-Trans-5811-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Compliance with the regulation concerning the nonflammability of materials used for brake linings and friction coupling linings is discussed for working areas having a fire, or explosive hazard due to the occurrence of methane/air mixture, or coal dust/air mixtures. Instruction for conducting the tests are included. F.O.S.

N70-32529*# Franklin Inst., Philadelphia, Pa. Research Labs.
ANALYSIS AND PERFORMANCE OF THE GAS-LUBRICATED TILTING PAD THRUST BEARING Interim Technical Report
W. Shapiro and R. Colshar Oct. 1968 67 p Sponsored in part by NASA and AEC
(Contract Nonr-2342(00))
(NASA-CR-110687; AD-680033; I-A2049-30) Avail: CFSTI CSCL 13/9

The inherent self aligning capability and superior resistance to thermal distortion, of the gas-lubricated tilting-pad thrust bearing could often offset load capacity limitations and make it an attractive compromise for many applications. A numerical treatment for analyzing the tilting-pad thrust bearing is presented along with extensive performance information for a particular pad geometry. An optimum hydrodynamic crown profile and related dimensions are determined. The range of validity of incompressible theory and the rectangular approximation are also developed. Author (TAB)

N70-32537*# Franklin Inst., Philadelphia, Pa. Research Labs.
SOME REFINEMENTS OF THE THEORY OF THE VISCOUS SCREW PUMP Interim Report
H. G. Elrod Mar. 1969 52 p refs Sponsored in part by NASA and AEC
(Contract Nonr-2342(00))
(NASA-CR-110683; AD-684830; I-A2049-32) Avail: CFSTI CSCL 13K

Recently-performed analysis for herringbone thrust bearings has been incorporated into the theory of the viscous screw pump for Newtonian fluids. In addition, certain earlier corrections for sidewall and channel curvature effects have been simplified. The result is a single, refined formula for the prediction of the pressure-flow relation for these pumps. Author (TAB)

N70-32551# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BORONIZING MOLYBDENUM FROM VAPOR PHASE
V. N. Karev et al 19 Mar. 1970 9 p ref Transl. into ENGLISH from 3d Seminar po Zharostoykim Pokrytiyam, 1966 (Leningrad, 1968 p 99–102
(AD-704838; FTD-MT-24-320-69) Avail: CFSTI CSCL 13/8

The vapor phase deposition of boron on molybdenum sheet specimens was studied over the temperature interval of 1200-1600K, with boron being deposited by thermal decomposition of BI3 in a specially constructed apparatus and with BI3 being synthesized in the same apparatus directly from the elements. The deposition of boron began at 1200K and gave the best results, i.e. dense and strongly adhering deposits of boron, at 1470-1600K. The microstructure and crystal structure of the deposited boron layer were investigated, and the surface boron layer was found to contain Mo_2B_5 as well as MoB_2. It was concluded that molybdenum may be borated by thermal decomposition of BI3. TAB

N70-32583 National Lending Library for Science and Technology, Boston Spa (England).
DEVELOPMENT OF LIQUID NITROGEN TECHNOLOGY 1267 SYNCHRONOUS FARADAY ac PUMP
Reio Araki et al 3 Mar. 1970 3 p Transl. into ENGLISH from Japan. Conf. Paper Presented at the Ann. Meeting of the At. Soc. of Japan, Mar. 1968
(NLL-RISLEY-Trans-1885-(9091.9F) Avail: Natl. Lending Library.

Boston Spa, Engl.: 1 NLL photocopy coupon

The optimum operation of a liquid nitrogen electromagnetic pump is analyzed. Results of performance tests of an experimental pump are tabulated, and it is shown that the optimum rate for this pump is approximately 230 liters/min. F.O.S.

N70-32603# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOSCOW INSTITUTE OF STEEL AND ALLOYS. COLLECTED PAPERS: SELECTED ARTICLES

I. M. Pavlov et al 2 Mar. 1970 81 p refs Transl. into ENGLISH from Sb Mosk. Inst. Stali Splavov (USSR), 1968 81 p

(AD-704762; FTD-MT-24-317-69) Avail: CFSTI CSCL 13/8

Contents: Basic directions in study of pressure working of metals under vacuum; Thermodynamic analysis of conditions of nonoxidizing rolling of molybdenum, tungsten, rhenium, copper and nickel; Thermodynamic analysis of conditions of nonoxidizing rolling of zirconium, titanium, niobium, tantalum and vanadium; The rolling of tungsten in conditions of low partial pressures of oxygen; Influence of conditions of rolling bimetals VT6S - Br.Kh08 and VT6S - Kh18N10T on electrical power parameters of the process; Study of the transition zone of bimetal VT6S - Br.Kh08, obtained by rolling under vacuum; Influence of annealing on composition and properties of the transition zone of bimetal VT6S - Br.Kh08 obtained by rolling under vacuum. TAB

N70-32637# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF THE TYPE OF LUBRICATION THE WEAR RESISTANCE OF COMPONENTS COMBINED WITH KAPROLON

V. N. Eremin 13 Feb. 1970 6 p Transl. into ENGLISH from Vestn. Sel'Skokhoz. Nauki Vses. Akad. Sel'Skokhoz. Nauk (Moscow), v. 14, no. 1, 1969 p 129–130

(AD-703548; FTD-HT-23-665-69) Avail: CFSTI CSCL 13/9

The friction and wear were studied between a steel shaft and nylon sleeve bearing. The friction coefficient varied between 0.60 and 0.74 when the bearing was not lubricated. The lubricants considerably improved the wear resistance of steel nylon surfaces. An increase in lubricant viscosity reduced and decreased the wear. Author (TAB)

N70-32646*# Massachusetts Inst. of Tech., Cambridge Charles Stark Draper Lab.

FABRICATION OF HEMISPHERICAL OPPOSED SELF-ACTING GAS BEARINGS FOR THE THIRD-GENERATION GYROSCOPE

Robert J. Schiesser Jun. 1970 20 p refs

(Contract NAS12-569)

(NASA-CR-110759; E-2508) Avail: CFSTI CSCL 13I

Techniques are outlined for the fabrication of spherical gas bearings by machine lapping and sputter etching. The problems associated with producing three-dimensional patterns on the spherical surfaces by photo-resist acid-etching techniques and sputter etching are discussed. Author

N70-32655*# Stanford Research Inst., Menlo Park, Calif.

INDUCTION PLASMA CALCINING OF PIGMENT PARTICLES FOR THERMAL CONTROL COATINGS Interim Technical Report, 1 Aug. 1969–31 Mar. 1970

E. P. Farley 8 May 1970 27 p refs

(Contract NAS8-21270; SRI Proj. PMU-7083)

(NASA-CR-102771; ITR-3) Avail: CFSTI CSCL 11C

The potential of using induction plasma heating techniques for calcining pigment particles in thermal control coatings was investigated. Fine particles of silicated zinc oxide and orthotitanate were dispersed in a carrier gas of argon and oxygen and heated by hot argon in an induction plasma. The crystal structure of the zinc orthotitanate pigment powders appears to be unaltered by plasma calcining. The particle morphology is altered to the extent that protuberances and sharp edges are removed, producing a rounding effect. Most of the particles are not appreciably altered in size, but the production of a new phase of very small particles shifts the average particle size at high plasma treatment temperatures. The chemical impurities present in the zinc orthotitanate are from the DuPont anatase starting material and, apparently, from the ceramic vessels used during synthesis. Plasma calcining does not appreciably affect the impurity content. Four electron paramagnetic resonances have been detected in the zinc orthotitanate. The changes in the value of these resonance lines indicate changes in susceptibility to UV radiation damage. Author

N70-32845*# IIT Research Inst., Chicago, Ill. Engineering Mechanics Div.

EVALUATION OF WEAR RESISTANCE OF FOURTEEN GEAR MATERIALS Final Technical Report, Jun. 1965 – Mar. 1970

W. J. Courtney Jun. 1970 121 p refs

(Contract NAS5-9590; Proj. J6020)

(NASA-CR-110655) Avail: CFSTI CSCL 13I

Eight gear materials are evaluated for wear characteristics. Four-square gear test fixtures, master gear arrangements, and instrumentation for the measurement of wear rates are described. Involute and cycloidal profile gears were used. The tests of involute gears show that the nitrided nitralloy and 440C stainless steel material combinations operate for the prescribed time in both laboratory and vacuum atmosphere. Combinations of Martin hard coated 7075T6 aluminum alloy with nitrided nitralloy and C1085 steel operate for the prescribed time in vacuum only. Cycloidal gears of carburized C1010 nitrided nitralloy and 440C stainless steel do not operate for the prescribed period in either vacuum or atmospheric environments without wearing more than 10 percent. Author

N70-32889*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.

HYDRODYNAMIC JOURNAL BEARING TEST AND ANALYSIS

R. J. Rossbach Washington NASA Jun. 1970 227 p refs

(Contract NAS3-6479)

(NASA-CR-1517; GESP-133) Avail: CFSTI CSCL 13I

Steady-state and dynamic test data, carried out with distilled water at 75 and 120 F as the lubricant, are presented for a pivoted-pad and a three-lobe bearing having an L/D of 1.0 and a preload (ratio of assembled to machined clearance) of approximately 0.5. Tests were made with the bearing centers aligned and misaligned to determine the effect on bearing stability. The test series with artificially misaligned bearings established (but to a known degree) what could occur with unfavorable thermal gradients. The maximum misalignment for the selected bearing and shaft combination was 467 seconds. Because of the requirement to determine the effects of misalignment on bearing performance, the diametral clearance selected for the three-lobe bearing was 5 mils while that for the self-aligning four-pad pivoted-pad bearing was 3.125 mils. The shaft diameter was 1.25 inches. The pivoted-pad bearing was also subjected to the selective fixture of pads. The speed and steady load test ranges were 8,000 to 32,000 rpm and 0 to 70 lb/bearing, respectively. The objective was to determine the performance change resulting from the misalignment or, in the case of the pivoted-pad bearing, the effect of fixing a pad. The pivoted-pad bearing was stable at all speeds up to 31,000 rpm and the three lobe bearing was stable up to rotational speeds of 26,000 rpm with elevated lubricant supply pressure. Author

N70-32939*# General Electric Co., Cincinnati, Ohio. Design Technology Operation.

COMPRESSOR END SEAL TEST AND DEVELOPMENT

A. N. Pope and C. C. Moore Jul. 1970 141 p
(Contract NAS3-10490)
(NASA-CR-72665) Avail: CFSTI CSCL 11A

Two new types of metallic, hydrostatic compressor end seals (22 inches in diameter) were designed, manufactured, and tested up to 600 ft/sec, 1000 F, and 175 psig. A hydrodynamic type was also evaluated. Compared to labyrinth seals, a 20 to 1 reduction in flow was achieved. These seals operated without contact at a film thickness less than 0.001 inch, using hydrostatic air-bearing principles, and are intended for use in aircraft gas turbines and related equipment. Author

N70-32946*# Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
CONTINUATION OF NASA ROCKET MOTOR DEFECTS INVESTIGATION, JUNE 1969 – MAY 1970
R. B. Enie May 1970 209 p refs
(Contract NAS1-9293)
(NASA-CR-66946) Avail: CFSTI CSCL 13H

Investigated were methods by which damaged fiberglass rocket motors can be successfully repaired. The following areas were investigated: (1) resin shear capabilities; (2) shear distribution improvements in the patch; (3) repair of cylindrical defects, and (4) effect of aging on resin shear strength. The investigation of the repair system provided the following conclusions: (1) that use of a rubber filler ply in the bond line between the parent case and the first ply can help to reduce peak shear stresses; (2) the present four-ply fiberglass cloth patch design has inadequate strength; (3) bottle hydroburst tests indicate that the shear strength of the Epon 946 resin bonded patch is significantly greater than previously indicated; (4) double-lap shear tests data indicated no significant loss in shear strength for the repair system after nine months of aging; and (5) for the best void-free application of a repair patch, individual plies must be applied separately. Except for the anti-fraying border, the resin must not be applied by any ply before positioning and rolling down the ply. Author

N70-33061*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIC FORCE UPSET WELDING OF DISSIMILAR THICKNESS STAINLESS-STEEL T-JOINTS
Kenneth H. Holko Washington Jul. 1970 30 p refs
(NASA-TN-D-5917; E-5624) Avail: CFSTI CSCL 13H

Sheet to plate T-joints were resistance welded using the magnetic force upset welding (MFUW) process. Both AISI Type 304 and Armco 17-7PH T-joints were evaluated. The best results were obtained with sheet beveled at the joint interface and the more ductile Type 304 plate. An unwelded area under the weld fillet caused a stress concentration that lowered the strength of 17-7PH weldments. Removal of the weld fillet or the use of more ductile Type 304 plate greatly improved weld strength. Welds in 17-7PH were as strong as the plate after removal of the weld fillet. MFUW was successful because of short heating times and magnetic force delay relative to weld current capability. Author

N70-33090*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLID-STATE WELDING OF TD-NICKEL BAR
Thomas J. Moore and Kenneth H. Holko Washington Jul. 1970 39 p refs
(NASA-TN-D-5918; E-5651) Avail: CFSTI CSCL 13H

Solid-state butt and lap joint welds were made in 1/2-inch diameter TD-nickel bar in a hot isostatic press at 2000 F and 20 ksi for 2 hours. Various interlayer materials were used in the butt joints. Best butt joint efficiency (percent of parent material strength) at 2000 F was obtained with a 0.004 inch cobalt-alloy interlayer; stress-rupture joint efficiency was 15 percent for 100-hour life and tensile joint efficiency was 100 percent. Thus, stress-rupture testing was found to be a more severe criterion. In short-time shear tests of lap joints (without interlayers) parent material shear strength was matched in 2000 F tests. Author

N70-33164*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ANALYSIS OF THE EFFECT OF DESIGN AND MEASUREMENT ERRORS ON PUMP PERFORMANCE PARAMETERS
Douglas A. Anderson Washington Jul. 1970 66 p refs
(NASA-TN-D-5919; E-4704) Avail: CFSTI CSCL 13K

Equations and carpet plots are presented which can be used for determining the effects of design and measurement errors on pump performance parameters. The design error equations apply to a blade element design procedure. The measurement error equations apply to pump tests in which radial surveys of pressure and angle measurements are made. Applications of the error analysis techniques are discussed. The effects of changes in stagger angle and loading on the sensitivity of the performance parameters to design and measurement errors are deduced. Author

N70-33165*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PERFORMANCE OF A 2 TO 10 KILOWATT BRAYTON ROTATING UNIT
Hugh A. Klassen, Charles H. Winzig, Robert C. Evans, and Robert Y. Wong Washington Jul. 1970 27 p refs
(NASA-TM-X-2043; E-5456) Avail: CFSTI CSCL 13I

The operational test and evaluation of a Brayton Cycle power generator is described. The testing included 1005 hours of hot operation and covered a wide range of pressure, temperature, and power levels. Bearing operation was stable at all times. Investigations were made of component motions, bearing loads, pneumatic hammer, hydrostatic flow rates, thrust bearing clearances, transient performance, and bearing ambient pressure. Predicted internal temperatures are compared with actual temperatures for three power levels. Author

N70-33180* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FOLDING APPARATUS Patent
Wade E. Lanford, inventor (to NASA) Issued 28 Nov. 1961 (Filed 11 Feb. 1960) 4 p Cl. 93-1
(NASA-Case-XLA-00137; US-Patent-3,010,372; US-Patent-Appl-SN-8203) Avail: US Patent Office CSCL 13I

A folding apparatus and method for folding thin flexible sheets helically and vertically simultaneously to form a compact packaged configuration are described. The application of this technique is found in packaging of artificial satellites in a configuration which will permit extension or expansion by centrifugal force on being ejected into the upper atmosphere. P.N.F.

N70-33186*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLAT CONDUCTOR CABLE DESIGN, MANUFACTURE, AND INSTALLATION
W. Angele and James D. Hankins 9 Jan. 1970 437 p refs
(NASA-TM-X-53975) Avail: CFSTI CSCL 09A

Pertinent information for hardware selection, design, manufacture, and quality control necessary for flat-conductor cable interconnecting harness application is presented. Detailed information is provided on cable, connectors, and support hardware that has been developed on various programs. The relation of this hardware to the new MIL-C-55543 and MIL-C-55544 specifications for flat-conductor cable and flat conductor cable connectors is defined. Comparisons are made between round-wire cable and flat-conductor cable. The flat conductor cable interconnecting

harness systems show major cost, weight, and space savings, plus increased system performance and reliability. The design application includes electrical characteristics, harness design and development, and a full treatise on EMC considerations. Manufacturing and quality control pertain primarily to the NASA/MSFC developed conductor-contact connection system and special flat conductor cable to round-wire cable transitions. Author

N70-33228* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSPIRATION COOLED TURBINE BLADE MANUFACTURED FROM WIRES Patent
Ernst R. G. Eckert, inventor (to NASA) Issued 5 Dec. 1961 (Filed 20 Oct. 1953) 3 p Cl. 253-39.15
(NASA-Case-XLE-00020; US-Patent-3, 011, 760; US-Patent-Appl-SN-387332) Avail: US Patent Office CSCL 21E

The development of a turbine blade with a body consisting of a plurality of wires made of metal, ceramic, or other materials is described. The wires are arranged with their longitudinal axes generally parallel to the blade axis, with or without a stiffener insert, and with ample porosity provided for transpiration cooling. The axes of the blade fibers or wires are so arranged as to provide ample strength to withstand centrifugal forces. A.L.

N70-33284* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFICATION AND IMPROVEMENTS TO COOLED BLADES Patent
Andre J. Meyer, Jr. and Howard F. Calvert, inventors (to NASA) Issued 9 Oct. 1962 (Filed 20 Aug. 1959) 7 p Cl. 253-39.15
(NASA-Case-XLE-00092; US-Patent-3, 057, 597; US-Patent-Appl-SN-835146) Avail: US Patent Office CSCL 21E

Air-cooled turbine blades and vanes are investigated with the object of causing the cooling medium to depart the blade in a region where the static pressure of the main hot gas stream is always less than the supply pressure. It was also desired to prevent hot gases from entering the airfoil section where the external pressure is greater than the internal coolant pressure. Methods are discussed for preventing the blade leading edge from failing prematurely due to inadequate cooling and for providing a tip cap partially covering the open end of the rotor blade to let the cooling air to the leading edge discharge into a lower pressure region. Internal-corrugation configurations are considered with a high internal surface area at the leading edge which directs a maximum amount of cooling air to the edge. R.B.

N70-33311* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCESS FOR APPLYING A PROTECTIVE COATING FOR SALT BATH BRAZING Patent
Allen C. Francisco and Charles A. Gyorgak, inventors (to NASA) Issued 14 Nov. 1961 (Filed 27 Sep. 1957) 1 p Cl. 29-488
Continuation-in-part of US Patent Appl. SN-468590, Filed 12 Nov. 1954
(NASA-Case-XLE-00046; US-Patent-3, 008, 229; US-Patent-Appl-SN-686796) Avail: US Patent Office CSCL 13H

Prior to the brazing step, the braze material is covered with a coating of protective substance of such texture and properties so as to prevent damage to the braze material during the period after insertion of the work in the salt bath and prior to melting and free flow on the surfaces to be joined. Any of the clays or binders common to the ceramic and related arts are suitable as effective protective agents. R.B.

N70-33323* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INSULATING STRUCTURE Patent
Dale L. Burrows, inventor (to NASA) Issued 12 Dec. 1961 (Filed 20 Dec. 1960) 3 p Cl. 62-45)
(NASA-Case-XMF-00341; US-Patent-3, 012, 407; US-Patent-Appl-SN-77256) Avail: US Patent Office CSCL 13A

An insulating system for receptacles or pipes confining low temperature materials such as liquified gases, is described. It provides a frost layer spaced from the receptacle which is not easily blown or shaken off, and acts as an efficient insulating barrier. Ordinary screen wire normally used for insect protection is wrapped around the receptacle on which the frost forms. F.O.

N70-33330* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIRE GRID FORMING APPARATUS Patent
John L. Bonn and Daniel E. Gardner, inventors (to NASA) Issued 11 Jul. 1961 (Filed 31 May 1955) 3 p Cl. 78-1
(NASA-Case-XLE-00023; US-Patent-2, 991, 671; US-Patent-Appl-SN-512352) Avail: US Patent Office CSCL 13I

An apparatus for forming wire grids which are applicable to any test structure and especially adaptable for use in electric strain gages is described. Two lines of pins protrude above a plate, and the wire is woven back and forth over the pins. A hardened flat steel block is placed on the pins and the unit is transferred to a press and subjected to pressure. A stabilized grid is produced which can be readily handled for direct use, storage, or shipment. N.E.N.

N70-33376* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLEXIBLE SEAL FOR VALVES Patent
Carmen Bibbo and Rowland E. Browning, inventors (to NASA) Issued 19 Jul. 1960 (Filed 8 Dec. 1955) 5 p Cl. 251-173
(NASA-Case-XLE-00101; US-Patent-2,945,667; US-Patent-Appl-SN-551961) Avail: US Patent Office CSCL 11A

An inflatable flexible seal for use over a wide range of operating pressures is described. The seal comprises a single ply flexible strip set in a circumferential groove in the butterfly valve casing with a two ply portion of substantially U-shaped part way around the shaft extension. The seal may be inflated when the valve is closed, and deflated and retracted when the valve is open. N.E.N.

N70-33382* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR MAKING A METAL SLURRY PRODUCT Patent
Thomas J. Walsh, Walter R. Witzke, and George M. Prok, inventors (to NASA) Issued 26 Apr. 1960 (Filed 22 Dec. 1955) 5 p Cl. 266-19
(NASA-Case-XLE-00010; US-Patent-2, 934, 331; US-Patent-Appl-SN-554899) Avail: US Patent Office CSCL 13A

A device is described for producing a hydrocarbon slurry containing extremely small particles of magnesium for use as a fuel in jet aircraft. The process reduces the size of the metal particles to the upper limit of the colloidal range, provides for metal vapor condensation in which the coolant forms part of the slurry product, and virtually eliminates the clogging of flow lines. R.B.

N70-33390# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
MACHINING TYPE AM 363 STAINLESS STEEL
J. D. Hensley and M. L. Shell 7 Apr. 1970 23 p
(Contract W-7405-eng-26)
(Y-SC-3) Avail: CFSTI

Machining tests were conducted on Type AM 363 stainless steel to determine the optimum machining conditions under single-point turning. For finish cuts, the work was performed on an American duplicator lathe. The workpiece was a log approximately

15 inches long and 5 inches in diameter. Results of the tests are presented and are the basis of recommended machining parameters. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-32205# Stanford Univ., Calif. Microwave Lab.
TUNABLE OPTICAL SOURCES Progress Report, 1 Oct. 1969 – 31 Mar. 1970
Apr. 1970 12 p
(Contract DAHC04-68-C-0048; ARPA Order 675)
(AD-704893; SU-ML-1847; PR-3) Avail: CFSTI CSCL 20/5

The purpose of this contract is to conduct investigations of materials and techniques leading to the realization of tunable coherent light sources. During this period work proceeded on materials and laser pump sources aimed at achieving the above objectives. Author (TAB)

N70-32208# Stanford Univ., Calif. Microwave Lab.
RESEARCH STUDIES ON OPTICAL PARAMETRIC OSCILLATION Final Report, 1 Dec. 1966 – 31 Dec. 1969
Stephen E. Harris Dec. 1969 12 p
(Contract F19628-67-C-0038)
(AD-703732; ML-1818; AFCRL-69-0553) Avail: CFSTI CSCL 20/5

The general areas which were studied during the contract period were: The use of cw gas lasers to make cw optical parametric oscillators; ruby pumped noncollinear oscillators; spontaneous parametric emission; phase locked parametric oscillators; the use of the 0.946 micrometer line in Nd:YAG as an oscillator pump; and most recently, a novel method to lock the output of an optical parametric oscillator to an atomic transition. Author (TAB)

N70-32463*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
HYDROGEN-MASER TIME AND FREQUENCY STANDARD AT GASSIZ OBSERVATORY
Martin W. Levine and Robert F. C. Vessot Apr. 1970 19 p refs Presented at the Symp. on Very Long-Baseline Interferometry, Charlottesville, Va., 13-15 Apr. 1970
(Contract NSR-09-015-098)
(NASA-CR-110689; Rept-004-20) Avail: CFSTI CSCL 20E

The hydrogen maser which was installed at the Harvard College Observatory/Smithsonian 84-ft radio telescope in Harvard, Massachusetts, for very long-baseline interferometry experiments 14 to 15 October 1969 and 22 November to 14 December 1969 is described. The maser is a compact unit, of relatively low power consumption, specifically designed for field use and readily transportable. A precision 5-MHz crystal oscillator, phase-locked to the maser, provides all frequency and time references for the VLBI receivers, recorders, and clocks. The maser was tuned against a rubidium standard by a rapid flux-switching technique; maser frequency resettability was estimated to be approximately + or − 3×10 to the minus 13th power with an overall accuracy of approximately + or − 1×10 to the minus 12th power. Loran-C was continuously monitored during the VLBI experiments, and the results of the Loran-C-maser comparisons are included. Author

N70-32489# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF THE NOISES IN A MATTED OSCILLATING ROD DUE TO THE PENETRATION OF THE RADIATION OF PUMPING
A. M. Samson et al 12 Jan. 1970 17 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Mat. Navuk (Minsk), No. 3, 1968 p 76 – 83
(AD-701988; FTD-MT-24-357-69) Avail: CFSTI CSCL 20/5

By employing various formulae, and using laser data for ruby and neodymium glass rods, varying their length, radius, pumping radiation, and determining values for luminance, amplification, and knowing the reflection coefficient, coefficient of internal losses, operating temperature, and radiation densities, the authors produced, analyzed and compared theoretical and experimental data that are in satisfactory agreement. Thus, noise density can be evaluated when the dimensions of the laser materials are varied, and also certain regularities involving the amplification of the noises in these rods can be calculated. Author (TAB)

N70-32495# Defense Documentation Center, Alexandria, Va.
HOLOGRAPHY, VOLUME 1 A DDC Bibliography, Mar. 1964 – Oct. 1969
May 1970 125 p refs
(AD-704950; DDC-TAS-70-15-1) Avail: CFSTI CSCL 14/5

The bibliography, Volume I of three volumes, contains 89 unclassified and unlimited references on Holography. The entries were selected from documents entered in the computer files between January 1960 and December 1969. Indexes by Corporate Author-Monitoring Agency, Subject, and Personal Author are included. Author (TAB)

N70-32668# Oregon Graduate Center for Study and Research, Portland.
MULTIWAVELENGTH LASER PROPAGATION STUDY, 2 Quarterly Progress Report, 15 Dec. 1969 – 15 Mar. 1970
Richard J. Kerr Apr. 1970 38 p refs
(Contract N00014-68-A-0461; ARPA Order 306)
(AD-704535; QPR-3) Avail: CFSTI CSCL 20/6

A series of significant multiwavelength laser propagation experiments were conducted with point-source transmitters and independent determinations of turbulence strengths. Under non-saturated scintillation conditions, it was found that the theoretical wavelength prediction of log amplitude variance is valid. Also, it was found that the near- and far-infrared wavelengths do not saturate at lower variances than visible wavelengths, and large infrared variances have been measured. It was found that different techniques for measuring the strength of turbulence yield different (but related) results. It was found that the multiwavelength covariance characteristics are usually independent of conditions and are near theoretical values, although certain anomalous results suggest limitations in the extent of the inertial subrange turbulence model. It was found that large receiver apertures do not result in the degree of reduction in total signal fluctuations that would be expected from the theory. Finally, it was found that simultaneous records of changing variances and turbulence strengths yield interesting characteristics which may be realted to the stationarity of the medium. Author (TAB)

N70-32686# Advisory Group for Aerospace Research and Development, Paris (France).
OPTO-ELECTRONICS SIGNAL PROCESSING TECHNIQUES
Feb. 1970 460 p refs Mostly in ENGLISH; partly in FRENCH Presented at AGARD Avionics Panel 17th Tech. Symp., Tonsberg, Norway, 29 Sep.-3 Oct. 1969
(AGARD-CP-50) Avail: CFSTI

Electro-optical signal processing techniques described cover communications systems, data recording and pro displays, holographic filters, and optical processing in real time with application of lasers. For individual titles, see N70-32687 through N70-32719.

N70-32688# Air Force Cambridge Research Labs., Bedford, Mass.
TUNABLE, COHERENT OSCILLATORS AND AMPLIFIERS IN THE VISIBLE AND NEAR INFRARED
A. Hordvik, H. R. Schlossberg, and C. M. Stickley *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 13 p refs (See N70-32686 17-16)
Avail: CFSTI

Since the construction of the first laser a substantial effort has been made to obtain tunable coherent sources. One method is to utilize a parametric process and this paper will concern itself with devices based on such a process. A brief outline will be given of the theory of the parametric oscillator as it relates to non-linear optical materials, followed by a discussion of the criteria which useful non-linear crystals must satisfy. The characteristics of the most important crystals available at the present time are tabulated. A short survey of the state of the art is presented, and experimental work on the non-linear crystal proustite will be described. Finally, a number of possible applications, both military and scientific are discussed. Author

N70-32689# Societe Anonyme de Telecommunications, Paris (France).
SOME NECESSARY DEVICES FOR 10.6 MICRON TELECOMMUNICATION SYSTEM [QUELQUES DISPOSITIFS NECESSAIRES A UNE LIAISON DE TELECOMMUNICATIONS SUR 10.6 mu]
A. Sorrentino, M. Siriex, J. Hober and D. Falquero *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 17 p refs In FRENCH, ENGLISH summary (See N70-32686 17-16)
Avail: CFSTI

10.6 micron telecommunications systems devices are presented: Cdx Hg(1-x) Te detectors show a peak in their spectral response which can be adjusted in the 8-13 micron range by varying the relative amounts of cadmium and mercury. Photovoltaic detectors are made from Cdx Hg(1-x) Te solid solutions obtained by the Bridgman method or by a vertical zone melting process. Diffusion of mercury in a p-type sample gives a p-n junction. These detectors operate at the temperature of liquid nitrogen. Modulators using electro-optic effect in gallium arsenide have been improved at high frequencies. They are used in the study of the frequency response of the detectors and for experimental telecommunications. Two types of modulators have been developed: (1) a multipass modulator: 0.1 modulation efficiency on a wide band operation (1-250 MHz), for an excitation power of 20 W; and (2) a traveling-wave modulator: 0.01 modulation efficiency up to 3 GHz for an excitation power of 2 W. Author

N70-32690# Royal Radar Establishment, Malvern (England).
UP-CONVERSION OF INFRARED RADIATION TO THE VISIBLE
John Warner *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 9 p refs (See N70-32686 17-16)
Copyright. Avail: CFSTI

Up-conversion is the name given to the non-linear optical process of sum-frequency generation where weak, usually infrared, signal radiation is mixed with an intense "pump" wave to generate sum-frequency radiation at or near the visible region of the spectrum. Depending upon what is used to detect the sum-frequency an up-converter/sum-frequency detector can be used: (1) to obtain visible images of infrared illuminated scenes; or (2) as a fast infrared detector which operates at room temperature. The factors which control the spectral bandwidth, angular field of view, infrared to visible conversion efficiency and image resolution will be discussed in this paper. An up-converter of 10.6 micrometers radiation using a ruby laser pumped proustite (Ag3AsS3) crystal is chosen as an example for experimental and theoretical study. Parameters measured in the laboratory include a bandwidth of about 0.3 cm at 10.6 micrometers a field of view of 300 mrad, a resolution of 15 mrad, and a photon conversion efficiency of 0.0000001. Methods for increasing some of these parameters, in particular the resolution and conversion efficiency will be discussed. Author

N70-32691*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
EFFICIENT OPTICAL COMMUNICATION WITHIN THE EARTH'S ATMOSPHERE
Estil V. Hoversten and Robert S. Kennedy *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 15 p refs (See N70-32686 17-16)
(Grant NGL-22-009-013)
Avail: CFSTI CSCL 20E

The earth's turbulent atmosphere causes any optical field received through it to fade in time and space. The utility of an optical communication system operating through the atmosphere can be severely limited by this fading unless appropriate signaling and receiving techniques are employed. The extent of these limitations is described by determining the performance that can be achieved with a near optimum receiver structure used in conjunction with an orthogonal set of signaling waveforms. The optimum receiver differs from those normally employed in that it utilizes the spatial diversity inherent in the fluctuations of the field across the receiving aperture. Unlike many receivers now contemplated, the performance of the optimum system continues to improve as the receiving antenna diameter is increased. If proper waveform parameters can be employed, the loss in performance due to turbulence is not excessive, e.g. the system capacity is not affected. Author

N70-32692# Compagnie Generale de Telegraphie sans Fil, Orsay (France). Lab. Central.
TELECOMMUNICATIONS IN THE INFRARED RANGE OF LAMBDA = 10.6 MICRONS [TELECOMMUNICATIONS DANS L'INFRAROUGE A lamda = 10.6 mu]
Eugene Leiba and Georges Assouline *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 12 p refs In FRENCH (See N70-32686 17-16)
Avail: CFSTI

The possibility of establishing a telecommunication system by laser in the infrared range at wavelength equals 10.6 microns is considered. The system is considered easy in the sense that the equipment is simple and does not require cooling. The equipment is composed of carbon dioxide laser of 0.5 watts, a modulator for carrier injection in the germanium, and a pyroelectric detector operating at ambient temperature. The bandpass is 400 KHz with a capacity of 12 volts. Transl. by J.M.C.

N70-32693# Perkin-Elmer Corp., Norwalk, Conn.
AN OPTICAL SPATIAL PHASE MODULATOR ARRAY, ACTIVATED BY OPTICAL SIGNALS
Freemont Reizman *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 14 p refs (See N70-32686 17-16)
(Contract F30602-67-C-0198)
Avail: CFSTI

A spatial optical phase modulator is described, in which the spatial variations of intensity of an optical input image are transformed into spatial phase variations in a reflected light wave. This device, called a photosensitive membrane light modulator, makes possible the real-time transformation of incoherent images into coherent form. Thus the methods of coherent optical processing can be used for images in incoherent light, or objects which would destroy coherence when imaged. Author

N70-32694# Air Force Cambridge Research Labs., Bedford, Mass.
TRANSVERSE MODE ELECTRO-OPTIC MATERIALS
A. F. Armington and J. J. O'Connor *In* AGARD Electron. Signal Process. Tech. Feb. 1970 12 p refs (See N70-32686 17-16)
Avail: CFSTI

Most electro-optic modulators presently used are crystals which exhibit a longitudinal electro-optic effect. It has been demonstrated that a more efficient modulator can be produced when a crystal having a transverse electro-optic effect is employed. Generally these crystals are produced either from the melt or from fluxes. Since melt grown crystals must be cooled through several hundred degrees and often must undergo phase transitions, these crystals are generally highly strained. Flux grown crystals are also unsatisfactory because of the tendency to incorporate the flux into the lattice. In this paper a method of producing crystals with a transverse electro-optic effect at room temperature is presented which results in strain-free crystals of high purity. The principal material discussed is cuprous chloride which has the added advantage that it has transparency in the infrared range out to at least twenty microns. The system used for the evaluation of materials will be discussed as well as results for cuprous chloride and other materials produced by room temperature techniques. Author

N70-32695# SHAPE Air Defense Technical Center, The Hague (Netherlands). Systems Research Div.

ELECTRON AND LASER BEAM STORAGE AND RETRIEVAL

J. F. Dove *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 9 p refs (See N70-32686 17-16)

Avail: CFSTI

Presented is a novel concept of high density storage and rapid access of digital information. One embodiment of this concept utilizes a very narrow, high energy, electron beam for digitally writing information as a "hole" or "no hole" on suitable recording media such as a thin metallic or semi-conductor film, tapes or cards. The read-out is accomplished by using a lower energy electron beam to illuminate the desired bit location. The same electron gun may be used for both recording and read-out. If there is a hole at the illuminated bit location, then it will be sensed by a collector plate located behind the recording surface. This allows the use of existing beam control and positioning circuitry in the read-out and in the write mode. This concept makes possible a device that has a storage of 10 to the 9th power bits per square inch with a read-out capability of hundreds of megahertz. This device can operate in either a random or a serial mode. It can operate in combination of modes such as in a tape configuration. The storage and display capability has been demonstrated in an experimental prototype of this device. Most of these capabilities can be achieved using the laser beam for write and read-out. The main difference between the performance capabilities of the electron and laser beam systems is that of beam scanning. Author

N70-32696# Compagnie General de Telegraphie sans Fil, Orsay (France). Lab. Central Thomson.

OPTICAL MEMORY HAVING LARGE CAPACITY WITH RAPID AND RANDOM ACCESS [MEMOIRE OPTIQUE A GRANDE CAPACITE AVEC ACCES ALEATOIRE ET RAPIDE]

Erich Spitz *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 13 p refs In FRENCH (See N70-32686 17-16)

Avail: CFSTI

The optical memory system is composed of monochromatic photoluminescent diodes, a plate containing nine micro-images with holographic lenses, and a network of detectors. The system is capable of storing 10 to the 8th bits of information. Results verifying the operation of the system are also included. Transl. by J.M.C.

N70-32697# Air Force Systems Command, Wright-Patterson AFB, Ohio. Avionics Lab.

LASER BEAM RECORDING AND DISPLAY: A PRECIS

Stanley J. Rostocki *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 17 p refs (See N70-32686 17-16)

Avail: CFSTI

Described are structure and function of the essential elements of a typical laser beam recorder. Next the light modulator, beam deflector and film handling components are singled out for critical comment and discussion. These three components are seen to require critical and tight tolerances both in manufacture and alignment. The transverse modulator with KDP crystals are the most efficient and practical today and may operate at bandwidths up to 100 MHz. Beam deflectors for greater than 400 spot diameters use a rotating polygon mirror and may operate at speeds in excess of 100,000 RPM. The critical factor in film handling is precision maintenance of the curved focal plane required by a rotating focussed beam of light. Laser beam display devices share most of the problems and advantages of LBR devices. But because of the additional complication introduced by a second orthogonal deflector, they are restricted to ground-based applications. LBR devices may eventually replace other means of line scan image recording in airborne devices because of the polarization, collimation and high brightness properties of the laser, but many practical problems must be solved before widespread use of such recorders is undertaken. Author

N70-32702# Compagnie Generale de Telegraphie sans Fil, Orsay (France). Lab. Central Thomson.

FILTERING OF SPATIAL FREQUENCIES BY EXAMINATION OF FORMS IN COHERENT LIGHT [RECONNAISSANCE DES FORMS PAR FILTRAGE DES FREQUENCES SPATIALES EN LUMIERE COHERENTE]

Alain Werts *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 15 p refs In FRENCH (See N70-32686 17-16)

Avail: CFSTI

The filtering of spatial frequencies is applied to the examination of signal forms in coherent light. The influence of the aberrations on the signal to noise ratio and on the total capacity of the parallel treatment is analyzed. The method used for minimizing the aberration is explained. Experimental results included: the recognition of an airplane in an aerial photograph, recognition of dactylographic characters, and identification of digital remains. Transl. by J.M.C.

N70-32703# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.

THE USE OF HOLOGRAPHIC SUBTRACTION IN THE OPTICAL PROCESSING OF RECONNAISSANCE DATA

Michael A. Monahan, Keith Bromley, John F. Bryant, and Brian J. Thompson (Rochester Univ.) *In* AGARD Electron. Signal Process. Tech. Feb. 1970 13 p refs (See N70-32686 17-16)

Avail: CFSTI

The real time holographic subtraction technique is designed to subtract an undesired portion of an image from a given optical scene. A wave reconstructed from a hologram is shifted in phase by pion radians relative to the wave originally stored; thus, if two nearly-identical images of an input plane, one derived from a hologram and the other a direct image, are superimposed upon each other at a viewing screen the identical portions of the images are canceled, and the difference between the two is displayed. The method was verified experimentally for inputs which were simply binary, consisting of apertures in an opaque screen, and also for continuous-tone photographic transparencies. Difference images were successfully displayed in both cases. Author

N70-32706# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

CORRECTION OF MICROWAVE-IMAGES OF HOLOGRAPHIC FILTERING

G. Graf *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 11 p refs (See N70-32686 17-16)

Avail: CFSTI

Antennas with unfilled aperture show numerous sidelobes in their patterns. Radiometer images, taken by such antennas, appear distorted, since no point is sharply imaged, but is blurred to a "spread function" depending on the antenna diagram. Such

distorted images can be corrected later, if the spread function, i. e. the intensity distribution to which the image of a single point is blurred, is known. The correction can be obtained by filtering the Fourier spectrum of the distorted image. This can be done optically as it is easy to realize Fourier transforms by means of lenses. While TSUJIUCHI in performing similar filtering was using filters, the production of which is very tedious, we formed the complex filters in a mere photographic way from the function, thus making the correction method feasible at all. Author

N70-32707# British Aircraft Corp., London (England).
SPEECH RECOGNITION USING OPTICAL FILTERING
D. Leverington *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 13 p refs (See N70-32686 17-16)
Avail: CFSTI

The results of work aimed at applying the complex spatial filtering technique to the problem of speech recongition are described. Our initial experiment was concerned with the recognition of the numbers one to ten spoken by one person on four consecutive occasions. The success rate at the first attempt was 54% for the recognition of all of the utterances using filters made from the second set of utterances only. This could be increased to 68% if the difficult numbers 6 and 7 are left out of our analysis. After describing this experiment the problem of phoneme recognition is considered and then compared with the advantages and disadvantages of the optical system with the more usual electronic systems. Possible applications of a successful speech recognition system are also discussed. Author

N70-32708# Royal Aircraft Establishment, Farnborough (England).
LIMITATIONS OF THE PHOTOGRAPHIC PROCESS IN THE PREPARATION OF SPATIAL FREQUENCY FILTERS
G. E. Keyte *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 28 p refs (See N70-32686 17-16)
Avail: CFSTI

The technique of matched filtering is a well-known method of recongizing signals in a noisy background. The use of matched filters in coherent optical systems enables two-dimensional signals, or patterns, to be identified in a number of applications, such as character recognition or radar signal processing. In these applications the matched filter is usually made by recording the complex spatial frequency spectrum of the signal on a photographic emulsion, using holography. The use of photographic emulsions introduces several limitations into the process, among these being: dynamic range (which restricts the range of intensities and hence, spatial frequencies recorded), linearity (restricting accuracy of recording the spectrum). The performance of the filter may be assessed by observing its impulse response and its correlation with the signal it represents. The spatial frequency spectrum of the impulse response should ideally be identical to the original input frequency spectrum. Dissimilarities between the two spectra were measured for aerial photograph inputs, and these are related to the limitations of the photographic process. The effect of these limitations upon the autocorrelation response was studied and some methods for overcoming these limitations are introduced. Finally, a comparison is made between matched filtering as a correlation process and direct signal/signal correlation processes. Author

N70-32710# Conductron Corp., Ann Arbor, Mich.
ANALYSIS OF THE EFFECT OF NONLINEAR AMPLITUDE RESPONSE OF THE MATCHED FILTER ON THE MAGNITUDE AND SHAPE OF THE CORRELATION
D. A. Ansley, P. J. Peters, and J. C. Cassidy *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 17 p refs (See N70-32686 17-16)
(Contract F33615-67-C-1431)
Avail: CFSTI

A computer program was written to simulate the making of a matched filter and its response in the correlator. The experimentally measured curve for the film was used for the simulation. A series of filters was calculated with signal-to-reference ratios ranging from 0.0197 to 4.39. These filters were multiplied by the signal and then the inverse Fourier transform was calculated. If the filter was working linearly, the resulting amplitude signal in the output plane would be a triangular correlation. At signal-to-reference ratios of 0.286 and larger, the triangular correlation became distorted. The amplitude of the correlation as a function of signal-to-reference ratio was calculated. From this it was determined that the matched filter is linear for signal-to-reference ratios of 0.286 and smaller. The minimum amplitude was found to be limited by the noise of the system. The theoretical results were experimentally verified using a commercial coherent optical matched filter correlator. It was shown that the matched filter correlator can be operated linearly using Kodak 649F emulsion for recording the matched filter provided the proper signal-to-reference ratio is used and the exposure is biased correctly. Author

N70-32711# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SIMPLE COHERENT OPTICAL CORRELATOR
J. A. Boden *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 14 p refs (See N70-32686 17-16)
Avail: CFSTI

The theory and the experimental results of a simple coherent optical correlator, which contains only one single transforming lens are considered. The two functions to be correlated are recorded on two transparancies and located side-by-side in front of the lens. To remove the spurious terms in the cross-correlation spectrum the reference function is stored as a pure phase modulated pattern. The signal function is a carrier wave, modulated with the reference function, and is recorded successively on a photographic film as an amplitude transmission function. So, with some delay, the correlator can be used in real-time operation. Quite long-duration signals can be processed. It turns out that multichannel operation along with doppler shift indication can be achieved. The influence of several system and signal parameters on the correlation in the output plane is studied. All the requirements of the correlator can be met in a stationary set-up. Several parameters showed to be less critical than was expected. The filmspeed is quite critical; only variations up to about 0.001 can be tolarated. Author

N70-32712# Compagnie Generale de Telegraphie sans Fil, Orsay (France). Lab. Central Thomson.
TREATMENT OF RADAR SIGNALS BY OPTICAL CORRELATION [TRAITEMENT DES SIGNAUX RADARS PAR CORRELATION OPTIQUE]
Claude Skenderoff *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 11 p refs In FRENCH (See N70-32686 17-16)
Avail: CFSTI

Radar receptors are developed utilizing optical correlation of noncoherent and coherent light. Particular emphasis is placed on a standby receptor with a wide span using a pseudorandom code with 1000 digits, a Doppler pulse radar receptor, a delay system for detection of aircraft by satellite, and a standby radar for wide distance resolution. A comparison of the possibilities of using noncoherent and coherent is made. Transl. by M.M.C.

N70-32713# United Aircraft Corp., East Hartford, Conn. Res. Labs.
LASER-ACOUSTIC SIGNAL PROCESSING
M. J. Brienza and H. A. Heyna *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 16 p refs Supported by Navy (See N70-32686 17-16)
Avail: CFSTI

The feasibility of using the classical optical-acoustical interactions with presently available lasers, photodetectors, and

transducers to obtain continuously variable delays of signals up to 3 GHz is demonstrated. Low frequency operation has offered the use of some extremely simple techniques easily adaptable to compact practical configurations. With the use of scanning techniques novel and practical applications of these laser-acoustic techniques can be made to various areas of signal processing. Emphasis is placed on exploring the unique capabilities of the device. Author

N70-32714# Boeing Co., Seattle, Wash.
HIGH PROCESS GAIN OPTO-ELECTRONIC MATCHED FILTERS FOR COMMUNICATIONS APPLICATIONS
G. Roome, A. V. Bunker, and P. J. de Faye *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 20 p refs (See N70-32686 17-16)
(Contract AF 30(602)-4268)
Avail: CFSTI

The application of opto-electronic signal processing to a certain class of interference-resistant communications techniques is considered. The processing techniques are applicable to spread spectrum digital transmissions which are processed by a matched filter at the receiver. The analysis of optical delay line matched filters of the diffraction type is discussed. The analysis considers the basic ultrasonic light modulator, that is the modulation of a light source by a sonic wave. The sonic wave may represent a received spread spectrum signal or received noise or a combination of both. Two ultrasonic modulators in cascade perform the desired correlation or matched filter function. The analysis considers the effects of intermodulation of signal and noise and also the effects of the beamspreading and attenuation of the sonic signal in the delay lines. Finally, the design of a matched filter having 40 dB process gain is presented together with an estimate of its communications performance. Author

N70-32715# El-Sum Consultants, Atherton, Calif.
COHERENT OPTICAL PROCESSING OF ACOUSTICAL INFORMATION
H. M. A. El-Sum *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 19 p refs (See N70-32686 17-16)
Avail: CFSTI

When acoustical information is attended by a coherent background, the resultants field can be interrogated by a coherent optical wave for visualization of the acoustical field. The theory is rather a direct extention of optical holography. However, unlike optics, the availablity of linear acoustical detectors provides the flexibility of detecting and manipulating, independently, the amplitude and phase information of the acoustical fields, and, consequently, new techniques were developed. Of these techniques, the three well known ones are (a) the liquid-surface-levitation, (b) the scanning, and (c) the Bragg Diffraction or direct optical-acoustical fields interaction. The liquid-surface-levitation idea is based on the equilibrium, on the surface, between the acoustical field and the natural restoring forces, (gravitational and surface tension), of the liquid. The interference between the unknown acoustical signal and the background causes the surface to ripple. This rippled surface is equivalent to an acoustical hologram which may be photographed and optiely reconstructed, or directly used as an acoustical hologram which may be photographed and optiely reconstructed, or directly used as an opti-acoustical transducer to reveal a real-time reconstruction. The scanning techniques may be achieved by (1) sampling of the acoustical field, (2) electron beam scanning of an appropriate transducer, or (3) laser beam mapping of the field. These different approaches vary in sensitivity and speed of interrogation of the whole acoustical field. On the other hand, they all share in the feasibility of substituting the coherent background with an electronically simulated one of any desired waveform. The Bragg diffraction technique requires no background at all, since it is based on the direct interaction between the acoustical field and a homocentric light wave. The choice of one technique or another depends on the ultimate utilization of the processed information, the chemical and physical nature of the environment, the type of object, and the wavelengths of both the acoustical and optical radiations. Author

N70-32717# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENT OF ELEVATED ENGINE VELOCITIES BY LASER RADIATION [PROCEDES DE MESURE DE VITESSES ELEVEES D'ENGINS PAR RAYONNEMENT LASER]
H. D. vom Stein, B. Koch, Ph. Ratlau, and G. Schultze *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 14 p refs In FRENCH (See N70-32686 17-16)
Avail: CFSTI

Two methods for measuring the velocity of a fast object by Doppler radar in coherent light were experimentally studied in a laboratory. The two procedures are based on a variant of the method using the Michelson interferometer. From the signal to noise ratio measurements, it was concluded that the differential active method by Doppler radar was the most accurate method for analyzing the aerial engine trajectories. Transl. by J.M.C

N70-32718# Plessey Radar, Ltd., Cowes (England).
LASERS FOR MEASURING SLANT VISUAL RANGE
E. T. Hill *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 12 p refs (See N70-32686 17-16)
Avail: CFSTI

The topic of slant visual range is introduced by discussing the importance of monitoring slant visual range (S.V.R.) and runway visual range (R.V.R.) at civil airports. The implications, of the introduction of category 11 landings is emphasised, and problems posed in equipping category 11 runways with S.V.R. monitors outlined. The prediction of the visual sequence to be experienced by the pilot when landing is considered more important as a landing aid, than the prediction of slant visual range alone. The present methods of predicting visual sequence are described and their limitations evaluated. The types of instruments monitoring light backscattered from the atmosphere, are considered. Certain basic difficulties exist with this type of instrument including providing sufficiently intense light sources, correlating the backscattered signal with atmospheric extinction coefficient over the slant path being monitored and relating this to the visible region of the spectrum. The laser is shown to be the best available source of light for this application and the possibility of utilising the Raman frequency shifted return signal from nitrogen, rather than the Mie back-scattered signal from aerosols is discussed. Author

N70-32719# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AUTOMATIC AIMING SYSTEM FOR LASER RANGE FINDERS [SYSTEME DE POINTAGE AUTOMATIQUE POUR TELEMETRE A LASER]
R. Moreau *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 11 p refs In FRENCH; ENGLISH summary (See N70-32686 17-16)
Avail: CFSTI

The device presented uses in priority the directional information carried by the light beam transmitted by the laser and reflected by the target. The receiving unit is made of a telescope at whose focus is installed a deviation measuring device made of five photomultipliers. The detection and calculation logic is organized in view of optimizing the mount control, taking particular account of the low rate of recurrence of the laser signal, the possibility of an occasional gap in the echoes, the problems arising from target acquisition, and the possibility of introducing some complementary information not originated by the echoes themselves. The main characteristics of such a device are presented and its advantages are discussed. Author

N70-32726# Commissariat a l'Energie Atomique, Limeil (France).
LASER HEATING OF SOLID-STATE TARGETS
J. L. Bobin, J. P. Babuel-Peyrissac, F. Floux, G. Tonin, and C. Fauquignon [1969] 71 p refs Presented at Gordon Res. Conf. on Laser Interaction with Matter, Issaquah, Wash., 25-29 Aug. 1969
(CEA-Conf-1460; Conf-690825-1) Avail: AEC Depository Libraries

A theoretical model for laser interaction with solid-state deuterium is presented. Experimental results that support the theory are described. A plasma temperature varying as the power 2/3 of the flux is the main result of these investigations. Other experiments deal with a beryllium target on which measurements of local densities and temperature were made and confinement of laser-created plasmas by 300-kG magnetic induction.
Author (NSA)

N70-32791*# National Aeronautics and Space Administration, Washington, D.C.
LOCAL SPECTROGRAPHIC ANALYSIS OF MINERALS WITH USE OF A RUBY LASER
M. V. Bobrova et al Jul. 1970 5 p refs Transl. into ENGLISH from Vop. Obshch. Prikl. Fiz., Tr. Respub. Konf. (Alma-Ata), 1969 p 227-231
(NASA-TT-F-13045) Avail: CFSTI CSCL 20E

A method for spectrographic analysis of minerals was developed in which a ruby laser, a microscope, and a spectrograph were used. A 10 to 12 micron diameter laser beam was formed in the plane of the sample by a lens system and microscope. The mass evaporated from the sample area due to the action of laser beams was analyzed by spectrograph. Cu, Ag, and Zn spectral lines were detected during analysis of chalcosite grains; Ag, Pb, Cu, and Zn lines in galena samples ; and Ag 3280.7 and Ag 3382.9 A lines from analysis of natural Ag grains. Trace constituents were detected in the minerals with a relative sensitivity of 0.1 to 0.01%.
Author

N70-32799# Environmental Science Services Administration, Boulder, Colo. Wave Propagation Lab.
ATMOSPHERIC SCATTERING FROM A 1.15 MICRON LASER BEAM AND ITS OFF-AXIS DETECTABLE RANGE
Roger H. Kleen and Normal L. Abshire Feb. 1968 30 p refs
(ESSA-TR-ERL-90-WPL-5) Avail: SOD $0.35

The detectability of a laser beam through a fog can be predicted fairly accurately for various detector and collecting optical systems if temperature, relative humidity, and fog extinction coefficient are known. Smoke is much more variable and can not be characterized by only its extinction coefficient. Fog and smoke angular scattering patterns determined experimentally are presented.
Author

N70-32825*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
LASER HEATING OF IONIZED HELIUM
Victor E. Scherrer Washington Jul. 1970 8 p refs
(NASA-TN-D-5797; C-117) Avail: CFSTI CSCL 20E

A technique for generating a plasma by combined electrical discharge and focused laser heating is described. The initial plasma was formed by discharging a capacitor storing 2.5 J through helium. This electrical heating produced an electron temperature of 10 to 20 eV. The helium plasma was further heated by a focused laser beam. When the laser power density was 30 to 50 GW/sq cm at the surface of the plasma, the electron temperature of helium was increased by a factor of 2 to 6 to 26 to 42 eV. Time resolved spectral techniques were used to measure plasma temperatures.
Author

N70-32935*# Yale Univ., New Haven, Conn.
MASER AMPLIFICATION OF INCOHERENT RADIATION BY INTERSTELLAR OH
A. Icsevgi and W. E. Lamb, Jr. [1970] 73 p refs
(Grants NGR-07-004-035; AF-AFOSR-1324-67)
(NASA-CR-110546) Avail: CFSTI CSCL 20E

A model is proposed for the maser amplification of the emission lines of interstellar OH. Weak incoherent microwave radiation from an external source passes through an OH cloud and is enhanced by maser action. The amplifying medium is considered as a collection of thermally moving two-level molecules which undergo excitation to the upper level at a steady pump rate. The Maxwell's equations for the electromagnetic field are coupled to the quantum mechanical equations of motion for the molecular density matrix in a self-consistent way. A single equation is derived for the spectral density by assuming that the incoming radiation is completely incoherent. The steady-state solutions of this equation are investigated analytically and the equation itself is integrated numerically for several kinds of Doppler broadening. It is found that in the absence of molecular motion, the spectrum approaches a sigma-function at the resonance frequency as the radiation travels through the medium.
Author

N70-32971# Commissariat a l'Energie Atomique, Villeneuve-Saint-Georges (France).
LASER MATERIAL INTERACTION ON INTENSE SOURCE OF MULTICHARGED IONS [L'INTERACTION LASER-MATIERE SOURCE INTENSE D'IONS MULTICHARGES]
Gianfranco Tonon and Maxime Rabeau 1969 11 p refs In FRENCH Presented at Intern. Conf. on Ion Sources, Saclay, France, 18-20 Jun. 1969
(CEA-Conf-1342; Conf-690625-7) Avail: AEC Depository Libraries

It is shown that the laser-matter interaction is a source of heavy multicharged ions. From measurements made on the plasma it was established that, at strong lighting, the plasma was completely ionized and very directive, which is favorable for its utilization in a true ion source. The theoretical model adapted to this type of interaction shows the possibility of attaining high temperatures which, for iron for example, would make it possible to obtain ratio (Z)/A approximates 0.4 width lighting already attainable in the laboratory.
Author (NSA)

N70-32976*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics
EFFICIENT ANALOG COMMUNICATION OVER QUANTUM CHANNELS
Stewart D. Personick (Ph.D. Thesis) 15 May 1970 109 p refs Sponsored in part by Bell Telephone Labs., Inc.
(Grant NGL-22-009-013; Contract DA-28-043-AMC-02536(E))
(NASA-CR-110758; MIT-TR-477) Avail: CFSTI CSCL 20E

The axioms of quantum measurements are incorporated into current communication estimation theory so that the system limitation due to quantum effects can be understood, and optimal receivers and systems designed. The equations determining the optimal minimum mean-square-error estimator of a parameter imbedded in a quantum system are derived. Bounds analogous to the bounds of classical estimation theory are also derived, and then specialized to the case of an electromagnetic field in a bounded region of space. Bounds for estimation of parameters and waveforms imbedded in known and fading channels are derived. In examples optimal receivers for the commonly used classical modulation schemes, such as PPM, PAM, PM, DSBSC, are derived. The differences between classical and quantum systems in implementation and performance are emphasized. It is apparent from the examples and from the structure of the bounds, that quantum effects often appear as an additive white noise arising in heterodyne and

homodyne structure receivers. These receivers are not always optimal in performance or in implementation simplicity. Other receivers employing detection by photon counting are sometimes optimal or near optimal. Author

N70-33139# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE THERMAL MODE OF A PULSED CO-2 LASER
A. V. Eletskii et al [1970] 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektr. (USSR), v. 12, no. 3, 1970 p 540 - 543
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

A mathematical model is derived for the behavior of the gas temperature and the lifetime of the upper level in the pulsed mode. The lifetime varies during vibrational relaxation since the process is accompanied by the transition of vibrational into progressive energy. Agreement between the experimental results and calculations based on the model is achieved on the assumption that all the energy of the electric pulse is used to excite antisymmetric vibration of the CO2 molecule. R.B.

N70-33140# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE RADIATION SPECTRA OF CO-2 LASER GAS
L. F. Erybasheva et al [1970] 2 p refs Transl. into ENGLISH from Tr. Krasnodarsk. Gosudarst. Pedagog. Inst. (USSR), no. 118, 1969 p 87 - 89
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

The radiation spectra of gases and gas mixtures in the 2000 to 7000 A range were investigated under conditions similar to the generation mode for a CO2 laser. The band intensities detected in the stationary and pumping modes are presented in tabular form. R.B.

N70-33141# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL INVESTIGATION OF THE GENERATION SPECTRUM OF A HELIUM-NEON LASER (LAMBDA = 0.63 MICRONS) IN A THREE MIRROR CAVITY
V. G. Domelunksen et al [1970] 5 p refs Transl. into ENGLISH from Fiz. Gasovykh Lazerov (Leningrad), 1969 p 36 - 40
Avail: National Translation Center, John Crerar Library, Chicago, Ill. 60616

Cavities with different reflection coefficients of the center mirror and different relationships between the active and passive cavity lengths were studied. The results for the frequency shift of the active and passive cavities agree with earlier measurements. R.B.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-32102*# Florida Univ., Gainesville.
BOILING POINT OF URANIUM
A. G. Randol, III (Nuclear Fuel Services, Inc.), R. T. Schneider, and C. D. Kylstra *In its* Exptl. Invest. of a Uranium Plasma Pertinent to a self Sustaining Plasma Source May 1970 14 p refs (See N70-32101 17-25)
Avail: CFSTI CSCL 11F

The device used to generate the uranium plasma is described. Details of the electrical power, cooling, high pressure, gas, and data acquisition systems are given. A modification of the Nottingham equation for electric arc potential versus current is presented. The application of this arc electrical characteristics model is discussed in terms of the determination of the boiling point of the uranium anode. The evaluated boiling points of uranium between 1 atmosphere and 7 atmospheres are compared. Author

N70-32146*# National Areonautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
APPARENT SOLUBILITIES OF COMMERCIALLY PURE AND OXYGEN-DOPED TANTALUM AND NIOBIUM IN LIQUID POTASSIUM
Stephen Stecura Washington Jul. 1970 34 p refs
(NASA-TN-D-5875; E-5615) Avail: CFSTI CSCL 11F

The apparent solubility of tantalum in potassium at 1055 and 1287 K is about 72 and 240 ppm by weight and that of niobium at 1055 and 1287 K is about 48 and 210 ppm by weight, respectively. The calculated heats of solution for tantalum and niobium solubilities in pure liquid potassium are 13.9 + or - 1.3 and 17.1 + or - 1.6 kcal/mole (58.2 and 71.5 kJ/mole), respectively. These apparent solubility data are believed to provide the upper limit for the true solubilities of tantalum and niobium between 1055 and 1287 K. Intentional doping of tantalum and niobium metals with oxygen increased the apparent solubilities of these two metals in liquid potassium. This effect of oxygen was related to K3TaO4 and K3NbO4 ternary oxides, respectively. These ternary oxides were recovered and identified. A hypothesis is proposed to explain these observations and those previously observed by others. Author

N70-32255# Army Foreign Science and Technology Center, Washington, D.C.
INFLUENCE OF AN ULTRASONIC FIELD ON ANODIC DISSOLUTION OF CERTAIN METALS [VLIYANIE ULTRAZVUKOVOGO POLYA NA ANODNOE RASTVORENIE NEKOTORYKH METALLOV]
I. K. Marshakov et al 1970 11 p refs Transl. into ENGLISH from Elektrokhimiya (USSR), v. 5, no. 6, 1969 p 658 - 662
(AD-704886; FSTC-HT-23-190-70) Avail: CFSTI CSCL 11/6

Processes of metal precipitation in an ultrasonic field have been studied rather broadly, but the kinetics of anodic dissolution under these conditions has only rarely been the subject of investigations. Discussed is the process necessary for proper prediction of the overall mode of a galvanic bath or any other electrolyzer excited by ultrasonic sound. TAB

N70-32421# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CHARACTER OF TENSILE FRACTURE OF SAMPLES OF TITANIUM ALLOYS
I. M. Pavlov et al 11 Mar. 1970 14 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 1, 1969 p 126 - 131
(AD-705198; FTD-MT-24-380-69) Avail: CFSTI CSCL 11/6

The effect of the conditions of preliminary hot rolling (500-1100 degrees centigrade with 20-60 percent reduction) and subsequent cooling (in water, air, or asbestos) on the form of rupture characterizing a nunber of commercial Ti alloys (VT6S, VT14, VT15, and ST1) after subjection to tensile strain was studied. There was a clear correlation between the chemical composition, the rolling conditions, and the form of heat treatment, on the one hand, and the characteristic rupture cross section on the other. After rolling at 1000 degrees centigrade, for example VT15 had a high tendency towards intercrystallite rupture; after rolling at 900 degrees centigrade or under, the fracture had a streaky character. Author (TAB)

N70-32422# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF DELTA-FERRITE ON THE PROPERTIES OF LOW-CARON MARTENSITE STAINLESS STEELS
E. A. Sagalevich et al 27 Feb. 1970 12 p refs Transl. into ENGLISH from Sb. Tr. Tsentr. Nauchn.-Issled. Inst. Chernoi Met. (Moscow), No. 63, 1968 p 90–95
(AD-704770; FTD-MT-24-385-69) Avail: CFSTI CSCL 11/6

The formation of structurally free delta-ferrite in martensitic stainless steel greatly impairs its mechanical properties. Tests along the fiber showed lower notch toughness values, particularly at low testing temperatures; the cold-brittleness considerably increased while the work of crack propagation decreased in tests across the fiber and, particularly in the third direction (over the thickness of the plate), delta-ferrite was found to have a drastically negative effect on the mechanical properties. The brittleness of martensitic steel with the appearance of delta-ferrite is caused by the low resistance of ferrite to brittle failure, and apparently, the increase in martensite ductility due to the increase in carbon content in the martensite following its redistribution between the austenite and the delta-ferrite. TAB

N70-32448# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF STRUCTURAL TRANSFORMATIONS ON THE RELAXATION STABILITY OF AUSTENITIC STEELS AND ALLOYS
A. M. Borzdyka 6 Oct. 1969 14 p refs Transl. into ENGLISH from the Publ. "Vsesoyuznoe Nauchno-Teknicheskoe Soveshchaniye po Voprosam Prochnosti Materialov i Konstruktivnykh Elementov Pri Vysokikh Temperaturakh, 4th Kiev, 1967 p 251–257
(AD-700403; FTD-MT-24-188-69) Avail: CFSTI CSCL 11/6

The effect of structural changes (caused by volume reduction) on stress relaxation when the specimen length remains constant is examined. Relaxation curves of heat-resistant austenitic steel are compared with data from phase analysis. Steels 1Kh18N9T, Kh15N15V5T, EI164, and Kh15N65VMTYu are considered. The latter steel was tested for relaxation for 20,000 hr at 750C and at initial stresses of 200, 250, 300, and 350 MN/sq m (or at 33, 40, 45, 50, and 60 percent of the mean yield point at 750C). The steel was air hardened from 1080C and tempered for 16 hr at 900C. Two periods of stress relaxation were observed. After the first period (300-500 hr), the remaining stress was about 0.7 of the initial. In the second period, relaxation was less intensive. Greatly hardened alloys containing 25-40 percent secondary phases are considered to be completely unsuitable for long-term service under relaxation conditions. Author (TAB)

N70-32449# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATIONS OF A MOLYBDENUM-NICKEL-SILICON (Mo-Ni-Si) SYSTEM
R. V. Skolozdra et al 7 Nov. 1969 10 p refs Transl. into ENGLISH from Visn. Lvov Univ., Ser. Khim (USSR), no. 9, 1967 p 21–24
(AD-700416; FTD-HT-23-522-69) Avail: CFSTI CSCL 11/6

By x-ray-structural and microstructural analysis methods an Mo-Ni-Si system was investigated. An isothermal diagram at 1000 degrees centigrade was set up. The compound with a structure of type MgZn 2 (Lambda sub 1-phase) has a variable composition (12.5-26 at. percent Si with a molybdenum content of 33.3 at. percent). The existence of previously detected Mu- and R-phases was confirmed. The solubility of nickel in molybdenum silicides is slight (it does not exceed 4 at. percent). Author (TAB)

N70-32472*# Scripta Technica, Inc., Washington, D.C.
CREEP OF A MULTICOMPONENT NIOBIUM ALLOY
Ye. V. Vasilyeva et al NASA Jul. 1970 6 p refs Transl. into ENGLISH from Iz. Akad. Nauk SSSR, Metally (USSR), no. 4, Jul.-Aug. 1969 p 187–190
(Contract NASw-2036)
(NASA-TT-F-13126) Avail: CFSTI CSCL 11F

High-temperature steady creep was studied in the 1100-1320 C temperature and 6-15 kg/sq mm stress ranges in a niobium alloy containing 10.85% W, 5.8% Ti, 2.0% Zr, and 0.08% C. Under the conditions of the study, steady creep rate was observed to be an exponential function of temperature and a power function of stress. The alloy's fatigue strength was studied in the same temperature range, and its strength characteristics were evaluated with the aid of the Larson-Miller parametric relationship. The effectiveness of combining solution hardening with structural heterogenization in improving the high temperature properties of the alloy was demonstrated. Author

N70-32503# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CAVITATION AND HYDROABRASIVE RESISTANCE OF METALS IN HYDRAULIC TURBINES: SELECTED ARTICLES
V. V. Gavranev et al 31 Oct. 1969 20 p Transl. into ENGLISH from the book 'Kavitatsiya i Gidroshlifuyushchaya Stoykost Metallov v Gidravlisheskikh Turbinakh, Russian, 1965 p 95–104
(AD-703379; FTD-MT-24-247-69) Avail: CFSTI CSCL 11/6

Contents: The mechanism of cavitational destruction and changes in the surface layer of metals; Cavitational destruction in hydroturbines of the Kamsk Hydroelectric Power Plant. TAB

N70-32508# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF TITANIUM ALLOY FRACTURE UPON ROLLING
I. M. Pavlov et al 22 Sep. 1969 10 p refs Transl. into ENGLISH from Fiz. Khim. Obrabotki Materialov (USSR), no. 2, 1967 p 123–125
(AD-701981; FTD-HT-23-231-69(JPRS)) Avail: CFSTI CSCL 13/8

Titanium alloys (single-phase alpha-alloy VT1, complex-alloyed alpha-alloy ST1, two-phase alloys OT4, VT6S, VT14, and single-phase beta alloy VT15) always fracture on rolling at 500-800C. Bands, similar to macrolocalized strain bands in steel, and cracks are formed by the rolling. The microhardness of these bands, exceeding that of the basic metal, cannot be explained by single strain hardening. The formation of these bands in titanium alloys is attributed to phase transformations in the local heating sites under action of the heat effect. The local overheating causes low heat conductivity in the titanium alloys and more rapid deformation upon rolling. This belief is supported, for instance, by the increased heat effect and increased microhardness observed in VT14 on rolling at the lower temperatures. The structure of the bands, which are arranged diagonally to the cross section of the macrosections, differs from that of the base metal. In addition there are fine bands, also arranged at about 45 degrees to the sample surface. The use of fractional deformations instead of the large deformations usually encountered in thermomechanical treatment is recommended to reduce the probability of forming these bands and microcracks. Author (TAB)

N70-32541# National Materials Advisory Board, Washington, D.C.
TRENDS IN THE USE OF TIN
Mar. 1970 63 p refs Sponsored in part by Bur. of Mines
(Contract GS-OO-(P)-94008)
(NMAB-265) Avail: CFSTI

About half of the primary tin used in the United States has gone into making tin plate. With the development of adhesive and welded side seams for cans, a strong growth in the use of tin-free cans is expected. Under normal conditions, this development and other developments in substitute materials are expected to

cause an annual decline of 1.5 percent annually during the 1970-1977 interval. Moderately higher requirements for tin in solders and for miscellaneous applications as a whole are prognosticated. Total requirements indicate the need for slightly less tin in 1970 than in 1968, and a growth of about 5% between 1970 and 1977. Increasing industrialization in other non-Communist countries would normally indicate generally increased tin consumption, but this is compensated by the trend to use less tin per unit product. Consequently, over-all growth in tin consumption to 1977 is considered to be similar to that of the United States. Reserves of tin appear to be adequate for at least twenty to forty years.
Author

N70-32544# National Materials Advisory Board, Washington, D.C.
TRENDS IN THE USE OF VANADIUM Final Report, Jun. 1969 – Mar. 1970
Mar. 1970 57 p refs Sponsored in part by Bur. of Mines
(Contract GS-OO-(P)-94008)
(NMAB-267) Avail: CFSTI

The major source of vanadium in the future appears to be vandium-bearing magnetite ores from which vanadium will be co-produced during steel manufacturing. The growth areas of vanadium in the steel industry are in high-strength, low alloy steels (HSLA) and in possibly continuous casting of steel slabs and billets. The demand for vanadium in these steels is predicted to exceed all other cumulative uses of vanadium-with HSLA steels making the biggest demand. In the face of a substantial price rise or of a shortage in vanadium, columbium could be substituted in steels. The requirements for vanadium in titanium alloys will be proportional to the growth of the titanium industry. As yet, the choice has not been made between stainless steels and vanadium alloys as a fuel element cladding in fast breeder nuclear reactors. If vanadium alloys become the more desirable cladding, the increase in demand will not be felt for approximately fifteen years.
Author

N70-32545# National Materials Advisory Board, Washington, D.C.
TRENDS IN USAGE OF COLUMBIUM Final Report
Mar. 1970 86 p refs Sponsored in part by Bur. of Mines.
(Contract GS-00(P)-94008)
(NMAB-264) Avail: CFSTI

Uses of columbium in various applications are reviewed and estimates are made of future requirements. Currently, major applications are as additions to ferrour alloys and superalloys, with superalloy consumption expected to experience very rapid growth until 1972, with aerospace requirements probably utilizing the columbium-base alloys to a large extent in the future. Some possible substitutes for columbium are also reviewed. Basic to the demand for columbium is its availability. Both foreign and domestic resources are reviewed in light of past production and mineral reserves. The quantity and quality of columbium in the National Stockpile have also been reviewed. Current resources exceed present demands, but the anticipated 20% annual increase in superalloy production is expected to put some strain on the availability of high purity Cb2O5, unless pyrochlore concentrate becomes a source.
Author

N70-32549 National Lending Library for Science and Technology, Boston Spa (England).
ANODIC IRON
R. Scholder 28 Nov. 1969 11 p refs Transl. into ENGLISH from Angew. Chem. (Berlin), no. 49, 1936 p 225–259
(NLL-M-7891-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The chemical and electrochemical relationship of iron to water and alkalies were studied in the following investigations: (1) isolation of hydroxyferrate for ferroate solution, and (2) producing crystallized hydroxyferrites and chemically active isomer metaferrites(NaFeO3). It was concluded that the green and red coloration of the iron containing alkali on addition of Na2S is controlled by the formation of thio-hydroxy-ferroate and ferrite.
F.O.S.

N70-32580# Technische Hogeschool, Eindhoven (Netherlands).
HARDNESS AND DEFORMATION OF METALLIC MATERIALS [HAERTE UND VERFORMUNG METALLISCHER WERKSTOFFE]
Jan Alfons Hubert Ramaekers (Ph.D. Thesis) 2 Jun. 1970 111 p refs In DUTCH
Avail: CFSTI

Theoretical and experimental studies of metal forming techniques were compared in order to formulate deformation models and to develop from the plastic mechanical theory formulas for physical properties. Considered were drawing and stamping techniques, as well as hardness measurements. A mathematical approximation was obtained that considers actual material behavior, deformation hardnening, and final deformation forms for ideal plastic materials. The proposed approximation can be used for extrapolation after large degrees of deformation and for macro hardness.
Transl. by G.G.

N70-32607# Brookhaven National Lab., Upton, N.Y.
LOW TEMPERATURE IRON MEASUREMENTS
A. Mc Inturff and J. Claus [1969] 20 p Presented at the 3d Intern. Conf. on Magnet Technol., Hamburg Sponsored by AEC
(BNL-14556; Conf-700503-1) Avail: CFSTI

Magnetic measurements were made on low-carbon steel, 1.8% Si steel, and 3.25% Si steel at 4.2, 77, and 300 K, using magnetic fields up to 2.2 kOe. The magnetization and permeability values are tabulated. Hysteresis loops and coercive force were also measured. The steels were found to be anisotropic, with maximum permeability being highest for samples cut in the rolling direction of the sheets.
NSA

N70-32617# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE APPLICATION OF TIME-TEMPERATURE PARAMETERS FOR THE PREDICTION OF LONG TERM ELEVATED TEMPERATURE PROPERTIES USING COMPUTERISED TECHNIQUES
R. P. Harvey and M. J. May 1969 22 p refs
(MG/Q/183/69) Avail: CFSTI

A computer based system for the processing of large amounts of creep rupture data is briefly described. The practical problems encountered in attempting to provide accurate creep rupture strength values for material specifications are considered, with particular reference to the selection and application of time-temperature parameters for extrapolation. Experience with the use of a computer method for optimisation of the constants of the generalized equation of Manson and its application to different steels and conditions of test data are described. The influence of testing error and metallurgical features on scatter and extrapolation difficulties are considered and preliminary results of a statistical survey of prediction accuracies are presented.
Author

N70-32622# British Steel Corp., London (England). Metallurgy Div.
CONTROL OF THE AUSTENITE GRAIN SIZE BY SMALL ADDITIONS OF TITANIUM
T. George and J. J. Irani May 1968 13 p refs Presented at the AIM Conf., New Castel
(MG/C/32/68) Avail: CFSTI

The grain coarsening characteristics of several titanium bearing steels have been examined. It has been found that a small amount of finely dispersed TiN in low Ti-high N steels is effective in controlling the austenite grain size up to temperatures of approximately 1200 C. Where TiC is present in addition to TiN the

grain coarsening temperatures are markedly lower and an explanation for this is put forward on the basis of the results of a detailed experimental examination. The results of laboratory plate rolling trials have shown that a refinement of the austenite grain size prior to rolling was not of itself sufficient to ensure a fine ferrite grain size after finish rolling to high temperatures. Author

N70-32883# Brookhaven National Lab., Upton, N.Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW. A BIMONTHLY TECHNICAL PROGRESS REVIEW, VOLUME 7, NO. 4
Aug. 1969 159 p refs Sponsored by AEC
(BNL-50204) Avail: CFSTI

All phases of high-temperature liquid-metal technology, including materials development, corrosion and mass transfer, heat transfer, fluid dynamics, instrumentation, purification, component development, physical properties, thermodynamics, chemical analysis, and power systems are covered. Up-to-date information on the various research and development programs in the United States is summarized. A list of reports issued in Europe in this field is appended. NSA

N70-32790 National Lending Library for Science and Technology, Boston Spa (England).
PROBLEM OF ASSESSING THE RESISTANCE OF STEEL TO BRITTLE FRACTURE FROM IMPACT STRENGTH TESTS
B. A. Stetsenko [1970] 4 p Transl. into ENGLISH from Zarodskaya Lab. (USSR), v. 35, no. 5, 1969 p 618-620
(NLL-RISELY-Trans-1779-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Results of static bending tests on three types of steels are discussed. Stress-strain diagrams provided maximum load, plastic deflection, and crack formation energy data. E.C.

N70-32800*# Syracuse Univ. Research Inst., N.Y. Dept. of Chemical Engineering and Metallurgy.
ADHESION BETWEEN ATOMICALLY PURE METALLIC SURFACES, PART 4 Semiannual Report
D. V. Keller, Jr. and M. Tsai Dec. 1968 27 p refs
(Grant NGR-33-022-004)
(NASA-CR-99080; Met-1100-0169-SA) Avail: CFSTI CSCL 11F

Metallic adhesion brought about through the normal compression of two real surfaces is considered. The process of real area expansion to accept the impressed load results in the plastic deformation of asperities even before microplastic deformation is initiated. The size distribution of the asperities is Gaussian in form, hence some contact points supporting the load will have experienced nearly 100% deformation while others may have only received weak elastic interactions. The rate of dispersal of the contaminant barrier which inhibits high adhesion strengths has been shown to be a function of the degree of substrate deformation irrespective of the amount or the character of the contaminating layer. The mechanism of metallic adhesion, therefore, is directly dependent on the available energy inputs to the interface, which can bring about complete dispersal of the interfacial contaminants. At compressive loads which are not sufficient to permit the equation of the real area of contact and nominal area of contact, the system must be considered a multipoint contact problem with the resistance to fracture of each point contact dependent on the prior history of that point. Author

N70-32903*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
EVALUATION OF MECHANICAL PROPERTIES, OXIDATION RESISTANCE AND STRUCTURE OF SLURRY SILICIDE COATED T-222 Final Report
A. M. Filippi 19 Dec. 1969 152 p refs
(Contract NAS3-12410)
(NASA-CR-72713; WANL-PR-(RRR)-001) Avail: CFSTI CSCL 11F

Slurry silicide coated tantalum alloy sheets were studied to define oxidation behavior, mechanical properties, and microstructural features. The as-applied coating displayed erratic oxidation behavior, surviving continuous oxidation on creep tests performed at 2400 F for over 400 hours, but failing in 21 to 304 hours on cyclic oxidation tests at this temperature. Failure of the as-applied coating occurred in 2 to 4 hours at 1400 F, but oxidation at higher temperatures prior to exposure at 1400 F eliminated this behavior. Bend, tensile and creep evaluation of coated material produced data consistent with that inherent in the alloy. Some increase in oxygen, nitrogen and carbon levels, primarily oxygen, was noted for the as-coated substrate, but little additional change was found after various oxidation tests. Interstitial element levels of coated samples were below that which would impair mechanical properties, but changes in precipitation from that characteristic of the alloy were noted. A primary oxide surface barrier of TiO_2 particles in a SiO_2 matrix formed during oxidation of the study coating. Oxidation also occurred within fissures and pores traversing the coating. Substrate recession due to reaction with the coating was measured for temperatures in the range 1000 F to 2400 F. An increase in coating-substrate reaction occurs at approximately 1600 F. Author

N70-32915# Idaho Nuclear Corp., Idaho Falls.
THE EFFECT OF HYDROGEN ON DUCTILE PROPERTIES OF IRRADIATED PRESSURE VESSEL STEELS
J. M. Beeston Feb. 1970 64 p refs
(Contract AT(10-1)-1230)
(IN-1359) Avail: CFSTI

The influence of hydrogen on the mechanical properties of several irradiated pressure vessel steels was investigated. Included in this investigation were ASTM A302B, A542, and HY-80 steel irradiated. Specimens were prepared and tested from plate sections of these steels which were quenched and tempered and some from A542 which were given prestrain and heat treatment modifications. The effects of strength level from irradiation, heat treatment, and microstructure were thus determined. Reductions in ductility and true fracture strength occurred with increasing hydrogen content but were not extensive at strength levels less than 180 ksi in specimens containing 1 to 2 ppM hydrogen. This concentration, however, produced a marked effect on the ductile properties when the strength level was increased by irradiation hardening or heat treatment beyond this threshold range. Irradiation hardening increased the magnitude of the decrease in the steels and conditions tested. Author (NSA)

N70-32942# Oak Ridge National Lab., Tenn.
PENETRATION OF REFRACTORY METALS BY ALKALI METALS
R. L. Klueh Apr. 1970 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2836) Avail: CFSTI

Under certain conditions liquid alkali metals penetrate tantalum and niobium rapidly along grain boundaries and certain crystallographic planes. Penetration is observed only when oxygen dissolved in the refractory metal exceeds some threshold concentration, which depends upon the refractory metal, the alkali metal, and the temperature. Penetration was first encountered in niobium and tantalum exposed to lithium, but has now been found when these metals are exposed to sodium, potassium, and the sodium-potassium eutectic. Oxygen levels required to effect penetration in niobium and tantalum by lithium, sodium, and potassium at 600 C are compared, and the rate of penetration is discussed in terms of a corrosion model. Author (NSA)

N70-32951# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF PSEUDOBINARY SECTION W2B-WC

OF TERNARY SYSTEM TUNGSTEN-BORON-CARBON
S. S. Kiparisov et al 10 Mar. 1970 11 p refs Transl. into ENGLISH from Sb., Mosk. Inst. Stali Splavov (USSR), no. 45, 1968 p 128–131
(AD-704836; FTD-MT-24-303-69) Avail: CFSTI CSCL 11/6

The interaction between the boride and carbide of tungsten over the pseudobinary section W(subscript 2)B-WC as well as certain properties of the pertinent alloys as a function of B and C content were investigated in specimens obtained by sintering the corresponding mixtures of W and B powders and hot pressing them in graphite compaction molds. Microstructural analysis of the obtained alloys showed that in all cases they have a two-phase microstructure consisting of crystals of the boride phase displaying a gray color following etching with a mixture of an alkali and potassium ferrocyanide and crystals of carbide phase displaying a white color. Author (TAB)

N70-32952# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
COMPRESSIVE STRAIN-RATE PROPERTIES OF THORIUM
R. A. Gallman and R. E. Oakes, Jr. 3 Mar. 1970 14 p refs
(Contract W-7405-eng-26)
(Y-1707) Avail: CFSTI

The strain-rate dependence of the mechanical properties of thorium in compression at room temperature was studied using an Instron testing machine and a split Hopkinson bar. Results revealed that thorium is strain-rate dependent even at low strain rates. Author (NSA)

N70-32961# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
INFLUENCE OF SURFACE DEFECTS ON SHORT TERM MECHANICAL PROPERTIES OF AUSTENITIC STAINLESS STEEL TUBING
T. Lauritzen, A. Montes, and A. Conti Dec. 1969 32 p refs
(Contract AT(04-3)-189)
(GEAP-13550) Avail: CFSTI

The short-term mechanical properties of austenitic stainless steel tubing containing local surface defects were evaluated by burst techniques. Thin-wall tubing of Type-316 with both naturally occurring and artificially-impressed defects was tested at 1100 and 1300 F. Nine tubes containing longitudinally-oriented surface defects failed at and along the defect. All but one of six tubes, which contained circumferentially and diagonally oriented defects, failed elsewhere. Longitudinal defects as deep as 25% of the wall and 1/8-inch long caused reductions in hoop strength no greater than 8% at 1300 F. This reduction is reflected in a 50% drop in fracture ductility. Tubes tested with circumferential and diagonal defects ranging in depth from 9 to 16% of the tube wall showed reductions of not more than 4.6% in hoop strength at 1300 F; these defects showed no perceptible effect on diametral ductility. Author (NSA)

N70-32973*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
BASIC RESEARCH ON LIQUID-DROP-IMPACT EROSION
O. G. Engel Washington NASA Jun. 1970 244 p refs
(Contract NASw-1481)
(NASA-CR-1559; GESP-253) Avail: CFSTI CSCL 11F

On the basis of additional cratering data that were collected, it was found that the equation for crater depth which was reported earlier is applicable only to pure face centered cubic metals. The restricted applicability of the equation was traced to differences in the yield behavior of the metals which result in different crater contours. To increase the applicability of the equation, a dimensionless quotient, which contains the yield stress and the elastic modulus both for the metal of the sphere, was added to the equation. The revised equation is in acceptable agreement with available low velocity cratering data for pure metals of all three lattice packing types and for alloys. Evidence of an elevated dynamic yield strength was found in the cratering curves of metals of the body centered cubic and hexagonal close-packed lattice types and in the case of Udimet 700 alloy. No evidence of an elevated dynamic yield strength has been found in the cratering curves of pure face centered cubic metals. Author

N70-33002# Hittman Associates, Inc., Columbia, Md.
HIGH TEMPERATURE METAL THERMAL SWITCH DEVELOPMENT PROGRAM Quarterly Report, Jul.–Sep. 1969
Mar. 1970 20 p refs
(Contract AT(29-2)-2797)
(HIT-421; QR-1) Avail: CFSTI

A thermal model of a typical high temperature heat source was formulated to evaluate potential thermal switch composites for reentry protection effectiveness. A total of 11 computer runs was made on various composite materials. All materials appear effective in protecting the heat source from earth orbital reentry. Alumina and zirconia were selected for the ceramic foam material to be used for metal impregnation and thermal switch studies. A survey of potential metal impregnants was conducted. Nickel and nickel/copper alloys appear to have the best combination of physical and thermal properties. Vacuum impregnation using salt solutions, fused salts and oxide slurries was evaluated as processes for fabricating metal/ceramic composites. Results indicated that the slurry impregnation technique is the most attractive process. Composites of various metal/ceramic combinations were fabricated with uniform metal coatings throughout the ceramic body. Nickel, nickel/copper and copper impregnated alumina and zirconia foams were prepared by the slurry impregnation process and tested for the thermal switch effect. Author (NSA)

N70-33004# California Univ., Livermore. Lawrence Radiation Lab.
HIGH STRENGTH, LOW TEMPERATURE BONDING OF BERYLLIUM AND OTHER METALS
James L. Knowles Feb. 1970 119 p refs
(UCRL-50766) Avail: CFSTI

The feasibility of techniques for bonding beryllium as well as other metals at low temperatures was investigated and the relationship of the bond parameters to the bond strength was determined. This study was guided by the following conditions: bonding temperature should be less than 600 F; plastic deformation of the parent metal should be minimized; and the bond should be nearly as strong as the parent metal. The final condition was intended to apply to type S 200 C beryllium. Most of this study concerned beryllium, but additional tests were made on molybdenum, stainless steel, tungsten, and commercially pure copper. Bonds could not be accomplished within the required temperature range and with small parent metal distortion without the use of an intermediate material. Consequently, all the results reported herein are for specimens with a plated dissimilar metal, generally silver, on the surfaces being joined. A special cleaning treatment was required after this second material was applied. Author (NSA)

N70-33005# Ohio State Univ. Research Foundation, Columbus.
STRESS CORROSION CRACKING AND GENERAL CORROSION OF IRON, NICKEL, CHROMIUM, AND THEIR ALLOYS IN CAUSTIC SOLUTIONS Quarterly Report, 15 Jan.–15 Aug. 1969
D. V. Subrahmanyam and R. W. Staehle 2 Feb. 1970 124 p refs
(Contract AT(11-1)-2018)
(COO-2018-4) Avail: CFSTI

This review considers the problems of general corrosion and stress corrosion cracking for Fe–Cr–Ni alloys in caustic environments. Environments considered are primarily NaOH-H2O over a broad range of temperatures. Information is presented in areas of thermodynamics, electrochemical kinetics, corrosion rates, SCC

phenomena, structures of passive films, and inhibitors. Materials considered are iron, chromium, and nickel, as well as binary and ternary alloys. Author (NSA)

N70-33025# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
TENSILE STRAIN RATE PROPERTIES
R. E. Oakes, Jr. and R. A. Gallman 27 Feb. 1970 11 p refs
(Contract W-7405-eng-26)
(Y-1708) Avail: CFSTI

A study was made of the effects of strain rate on the tensile properties of thorium. The yield point, tensile strength, and breaking strength increased proportionally with rate, while the ductility decreased slightly. Author (NSA)

N70-33049*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ISOTOPE EFFECT IN beta-ZIRCONIUM
Donald Graham and Earl R. Hanes, Jr. Washington Jul. 1970 22 p refs
(NASA-TN-D-5905; E-5094) Avail: CFSTI CSCL 07D

The isotope effect has been determined for Zr-89 and Zr-95 in beta-zirconium. The migration rate is independent of the tracer mass within experimental error at 942 C, 1186 C, 1784 C, and 1815 C. The maximum value of diffusion coefficient ratio D sub 89/D sub 95 is 1.002 + or - 0.005. An anneal at 1750 C for 8 hours immediately followed by the deposition and diffusion of niobium 95 in the beta phase at 1025 C resulted in a threefold reduction of the diffusion coefficient over that measured conventionally by depositing the tracer at room temperature in the alpha phase. It is suggested that the anomalous diffusion characteristics of zirconium, titanium, and hafnium can be accounted for by the presence of a short circuit network. Author

N70-33070# Brookhaven National Lab., Upton, N.Y.
HIGH TEMPERATURE LIQUID METAL TECHNOLOGY REVIEW, VOLUME 7, NO. 6 Bimonthly Technical Progress Review
Dec. 1969 47 p refs Supported by AEC
(BNL-50223) Avail: CFSTI

Reviews of information related to liquid metal technology are included on fluid dynamics, heat transfer, corrosion and erosion, instrumentation, component development, systems studies, chemistry, fabrication, safety and liquid metal purification. NSA

N70-33074*# Martin Marietta Corp., Denver, Colo.
EXPERIMENTAL STUDY OF POP-IN BEHAVIOR OF SURFACE FLAW-TYPE CRACKS Final Report
Fred R. Schwartzberg, Richard H. Gibb, and Emory J. Beck Jul. 1970 65 p refs
(Contract NAS9-9579)
(NASA-CR-108457) Avail: CFSTI CSCL 11F

Titanium alloy 6A lambda-4V STA was evaluated in order to determine whether flaw growth occurring during proof testing of hardware results from pop-in or slow growth. The factors that affect such growth and the effect of subsequent service life were also determined. The results showed that crack extension was of the slow growth type, initiating at stress intensities above 85% of the critical stress intensity. Growth was found to be minor at cryogenic temperatures and modest at room temperature. It was concluded that the susceptibility to slow growth is strongly influenced by crack size. The great value of the cryogenic proof test was confirmed. Author

N70-33080# Iowa State Univ. of Science and Technology, Ames.
AN ANNOTATED BIBLIOGRAPHY FOR GROWTH OF MULTI-ELEMENT SINGLE CRYSTALS OF METALS AND METALLOIDS
M. J. Murtha and George Burnet Feb. 1970 29 p refs
(Contract W-7405-eng-82)
(IS-2184) Avail: CFSTI

A list of abstracted references specifically relating to the growth of binary and multi-element metal and metalloid single crystals is presented. These references provide information required for preparing many compound single crystals, and is a guide for the preparation of new compound single crystals. Indexes by compound and growth method are included. Author (NSA)

N70-33081# National Lead Co. of Ohio, Cincinnati.
EFFECT OF SMALL ADDITIONS OF IRON, SILICON, AND ALUMINUM ON THE HARDNESS AND DEFORMATION OF CAST URANIUM AT ELEVATED TEMPERATURES: STATISTICAL EVALUATION
P. L. Randall Mar. 1970 12 p refs
(Contract AT(30-1)-1156)
(NLCO-1049) Avail: CFSTI

Mechanical property data from 27 cast alloys of the U-Fe-Si-Al system were statistically evaluated. The alloy levels were 300 and 1000 ppM. Hardness and drop hammer values were obtained at temperatures ranging from 885 to 1200 F. Both resistance to deformation and hardness values decreased as temperatures increased and increased as the silicon level increased. Author (NSA)

N70-33125# Minnesota Univ., Minneapolis.
METALLURGICAL APPLICATION OF AUGER ELECTRON SPECTROSCOPY
D. F. Stein, R. E. Weber (Phys. Electron. Ind.), and P. W. Palmberg (N. Am. Rockwell, Thousand Oaks, Calif.) [1970] 34 p refs
(Contract AT(11-1)-1778)
(COO-1778-5) Avail: CFSTI

Information on the physics, history, experimental procedures and uses of this technique is presented. It is noted that auger electron emission spectroscopy shows promise in many areas of metallurgical research. The advantage of the technique is its application to sampling of very thin layers and its sensitivity to all of the elements, including the light elements. The technique, as presently developed, gives reproducible and accurate measurements NSA

N70-33130# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF WEAK SOLUTIONS IN LIQUID METAL AS ANALOG OF VAPOR PHASE FOR APPLICATION OF PROTECTIVE LAYERS ON EASILY CORRODIBLE MATERIALS
B. M. Vasyutinskiy et al 10 Mar. 1970 14 p refs Transl. into ENGLISH from the Publ. 'Vysokotemperaturnyy Pokrytiya, Trudy Seminar po Zharostoikim Pokrytiyan, Leningrad, 26-28 May 1965' Moscow, Izd-Vo Nauka, 1967 p 119-125
(AD-704763; FTD-MT-24-328-69) Avail: CFSTI CSCL 11/3

The article contains a discussion on the use of weak solutions as analog of the vapor phase for applying protective layers on oxidizing metals and other substances. TAB

N70-33243# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
INTERNAL FRICTION IN LOW TEMPERATURE IRRADIATED BCC METALS
V. Hivert, R. Pichon, H. Bilger, P. Bichon, J. Verdone et al [1969] 27 p refs Presented at the Intern. Conf. on Ultrasonic Attenuation and Internal Friction in Crystalline Solids, Providence
(CEA-CONF-1487; CONF-690944-1) Avail: AEC Depository Libraries

Internal friction peaks observed in irradiated iron and molybdenum are discussed. Because the interstitial causes a local reduction in the symmetry of the lattice it should, by its

reorientation, give rise to a mechanical relaxation phenomenon. The search for and the study of low frequency internal friction peaks is thus a method which should permit the identification of the free interstitials. Author

N70-33280# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
COMBINED SCANNING ELECTRON MICROSCOPY AND X-RAY MOCROANALYSIS IN METALLURGICAL NUCLEAR APPLICATIONS
L. Meny and M. Champigny 1969 23 p refs Presented at the 4th Natl. Conf. on Electron Microprobe Analysis, Pasadena, 16-18 Jul. 1969
(CEA-Conf-1441; Conf-690715-1) Avail: AEC Depository Libraries

Results of examinations of metallic nuclear materials using various commercial instruments are presented. Information is included on the lamellar structure of Al – Mg alloy, identification of intermetallic UMo10 Sn0.25, precipitates in steel, structure of intermetallic ZrCu1.6 Mo1 alloy, fracture specimen examination using electron microscope, and metallography methods using replicas. NSA

N70-33283* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE NICKEL-BASE ALLOY Patent
John C. Freche, inventor (to NASA) Issued 14 Feb. 1961 (Filed 23 Oct. 1959) 2 p Cl. 75-171
(NASA-Case-XLE-00151; US-Patent-2, 971, 837; US-Patent-Appl-SN-848481) Avail: US Patent Office CSCL 11F

A method for preparing a nickel base alloy series is described. The melt was made in a refractory crucible placed in a high frequency induction coil, and the additions were made in the order of nickel, chromium, molybdenum, vanadium, aluminum, and carbon. Closely controlled vacuum melting results in further improved properties. It is concluded that the alloys have better stress rupture properties, impact properties, castability, and properties suitable for jet engine turbine blades operating at 1800 F than existing commercial nickel or cobalt alloys. N.E.N.

N70-33288* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REINFORCED METALLIC COMPOSITES Patent
John W. Weeton, David L. Mc Daniels, Robert W. Jech, Robert E. Oldrieve, Donald W. Petrasek et al, inventors (to NASA) Issued 23 Feb. 1965 (Filed 23 Jan. 1964) 1 p Cl. 29-198 Continuation-in-part of US Patent Appl. SN-64226, filed 21 Oct. 1960
(NASA-Case-XLE-02428; US-Patent-3, 170, 773; US-Patent-Appl-SN-339821) Avail: US Patent Office CSCL 11F

The invention consists of composite material composed of many high strength fibers such as tungsten fibers at 11 to 87 percent by volume, surrounded and dispersed in a lower strength but more ductile matrix or binder such as copper. The fibers have a diameter of less than 0.010 inch and a length equal to the full length of the specimen. Within the composite, fibers are oriented parallel to each other and parallel to the long dimension of the specimen and extend the full length of the specimen or the length of the stressed portion of the product. The objectives are to provide (1) a high strength and high strength-density ratio material for applications at normal room temperature and at elevated and cyrogenic temperatures; (2) a material having a high modulus of elasticity and modulus-to-density ratio over a wide temperature range; and (3) a fiber-reinforced metallic composite which maintains the original shape, size, and orientation of the fibers. M.G.J.

N70-33334# Atomic Energy Board, Pretoria (South Africa).
THE FABRICATION AND PROPERTIES OF URANO-URANIC OXIDE
J. M. Schaekers and G. H. B. Lovell Dec. 1969 10 p refs
(PEL-195) Avail: AEC Depository Libraries

Urano-uranic oxide was fabricated both by slip casting and by die pressing, followed in each case by sintering at temperatures up to 1400 C. High densities were achieved and lining bricks measuring 10.2 × 5.8 × 1.3 cm were produced. These are being considered for forming corrosion-resistant linings in vessels used for high-temperature uranium processing. The material was brittle, had a Vickers hardness of 488, modulus of rupture of 164 kg cm−2 and on heating to 450 C shrunk linearly by about 0.1% followed by a slight expansion on further heating, recovering its original length at about 800 C. It possessed high resistance to thermal cycling and thermal shock, and had a thermal conductivity of 0.0058 cal 0.1 cm 0.1 sec 0.1 C when measured on a porous disc, 85% of theoretical density. Author (NSA)

N70-33340# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
A NUMERICAL METHOD FOR STUDYING NORMAL FREEZING WITH VARIABLE SEGREGATION COEFFICIENTS
C. H. Li Jul. 1970 15 p refs
(RM-481) Avail: CFSTI

Freezing of alloy melts or even melts of "pure" metals greatly determines the impurity and defect type, content, or distribution in the frozen metal; and hence, the mechanical, electrical, optical, and other properties of the resultant device or product. Therefore, the study of melt freezing may often advance significantly some material preparation and control processes, such as zone refining, single crystal growth, formation of thin films or whiskers, and grain size or strength control in cast or welded structures. Only normal freezing is dealt with herein. Normal freezing represents an important and useful limiting case in the freezing of alloy melts. Author

N70-33361# Israel Program for Scientific Translations, Ltd., Jerusalem.
CORROSION OF STRUCTURAL MATERIALS IN SODIUM
B. A. Nevzorov 1970 106 p refs Transl. into ENGLISH of the book 'Korroziya Konstruktsionnykh Materialov v Natrii' Moscow, Atomidat., 1968 Sponsored by AEC and NSF *Its* Cat. No. 5447
(TT-69-55017; AEC-TR-6984) Copyright. Avail: CFSTI

A unified concept of physico-chemical approach to the effects of O2 in liquid Na on mechanisms of elementary corrosion processes, is reviewed. The experimental methods and corrosion test results of physical and chemical reactions between liquid metals and construction materials and the rate of disintegration of construction material are analyzed. The basic elementary processes of the coolant reactions with passive and oxide films (passivation or activation of construction materials in corrosion media), simple or selective solubility of solid metals (physical and chemical factors contributing to the acceleration or retardation of the process), penetration of liquid metals into solids (physical and chemical factors of frontal and intracrystal corrosion) and mass transfer of construction material components in the coolants were analyzed. NSA

N70-33399# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
MAGNETIC AND CRYSTALLOGRAPHIC PROPERTIES OF Pr-Gd ALLOYS
L. Tissot and A. Blaise 1969 7 p refs Presented at 15th Ann. Conf. on Magnetism and Magnetic Mater., Philadelphia, 18-21 Nov. 1969
(CEA-Conf-1476; Conf-691103-3) Avail: AEC Depository Libraries

Various Pr-Gd alloys, covering the whole range of compositions, were studied by x-ray diffraction and static magnetic measurements. The magnetization measurements were made in fields extending to 26 kOe in the temperature range 2 to 500 K. The following phase diagram with the corresponding magnetic properties is found: (1) a Pr-rich phase of double hexagonal structure that is paramagnetic

down to 2K and follows the Curie-Weiss law; (2) a Gd-rich phase of compact hexagonal structure that is ferromagnetic at low temperature; and (3) a phase based on the composition Pr2Gd5 of super hexagonal structure (analogous to the structure of Sm) that is antiferromagnetic at low temperature. Two alloys having compositions just either side of this superhexagonal phase were studied. Their magnetic behavior corresponds to that observed in ferrimagnets; the ferromagnetic Curie temperatures are higher than those observed in Gd93Pr7, situated in the Gd-rich phase. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-32068# Naval Research Lab., Washington, D.C.
NRL-MB-208: AN IMPROVED INSTRUMENT BALL BEARING LUBRICANT Interim Report
C. H. Blachly, V. G. Fitzsimmons, and H. Ravner 6 Mar. 1970 13 p refs
(AD-704466; NRL-7087) Avail: CFSTI CSCL 11/8

Operational requirements for thin film-lubricated miniature ball bearings for synchro/servo mechanisms are too severe for some marginal Specification MIL-L-6085A oils. The more critical requirements for these lubricants include low volatility, corrosion resistance, thin film and bulk liquid high-temperature oxidation stability, acceptable low temperature properties and cleanliness. A prototype formulation, was developed which incorporated the physical and chemical parameters required of the lubricant. The formulation is based on a neopentyl polyol ester and a dibasic acid ester mixture and contains additives to impart oxidation and corrosion stability. Laboratory data are presented to provide the basis for a comprehensive specification which will assure the quality and performance required of the lubricant. Author (TAB)

N70-32143# Catholic Univ. of America, Washington, D.C. Vitreous State Lab.
TOPOLOGICAL MODEL FOR VISCOUS RELAXATION IN CRITICAL OXIDE MIXTURES Technical Report, Aug. 1969–Apr. 1970
Joseph H. Simmons and Pedro B. Macedo Apr. 1970 32 p refs
(Contract N00014-68-A-0506-0002)
(AD-704910; TR-7) Avail: CFSTI CSCL 11/2

A topological model is formulated to analyze results from supercritical viscosity and ultrasonic relaxation measurements in molten oxide glasses. The model assumes that a distribution of relaxation times can be related to a distribution of environments and shows that the change in width of the distribution of relaxation times directly depends upon changes in the local composition. These changes in local composition are formulated in terms of the temperature dependent mean square compositioon fluctuation which appears above the liquid-liquid critical point. A final equation is then obtained which describes the change in the width of the relaxation time spectrum in terms of a parameter defined as the ratio of the range of structural forces to the supercritical correlation length. The final equation is compared to the results from ultrasonic spectroscopy, and is qualitatively extended to non-critical oxide systems. Author (TAB)

N70-32184# Owens-Illinois Technical Center, Toledo, Ohio.
CHARACTERIZATION OF MICROCRYSTALLINE PHASES IN GLASS-CERAMIC MATERIALS Final Report, 15 Apr. 1967–14 Apr. 1970
Gordon M. Muchow, Heinz Schulz, Chi-Tang Li, and Satyabrata Ray 14 Apr. 1970 244 p refs
(Contract N00014-67-C-0539)
(AD-705111) Avail: CFSTI CSCL 11/2

The report is concerned with the characterization of the high-quartz and keatite solid solutions which occur as important principal microcrystalline phases in glass-ceramic materials. The properties of these phases, sometimes very unusual such as negative thermal expansion, contribute significantly to the overall properties of glass-ceramic bodies. It was the primary objective of this research to determine the structures and chemical compositions of the solid solution phases, including details of crystal lattice defects in terms of specific order-disorder phenomena on a sub-micro, domain or unit cell scale. Author (TAB)

N70-32220# Drexel Univ., Philadelphia, Pa. Dept. of Metallurgical Engineering.
THE ROLE OF THE INTERFACE REGION ON THE MECHANICAL BEHAVIOR OF METAL-MATRIX COMPOSITES
M. R. Pinnel and A. Lawley Feb. 1970 28 p refs
(Contract N00014-67-A-0406-0001)
(AD-703850; TR-4) Avail: CFSTI CSCL 11/4

The tensile creep behavior and associated substructural detail have been characterized in aluminum-stainless steel composites at ambient temperature. Volume fractions in the range 0 to 0.33 were tested under constant load conditions (in the range 1.0 to 4.0 times macroscopic yield stress) with the load applied parallel to the direction of reinforcement. In both unreinforced aluminum and the composites, steady state creep conditions are established in < 100 hours. The stainless steel reinforcement significantly reduces the creep rate at a given stress level. Creep behavior is in agreement with that predicted by an exponential form of the rule-of-mixtures equation relating creep rate to applied stress and volume fraction reinforcement. Both fiber and matrix show an exponential dependence of creep-rate on stress with power exponents of 3.3 and 2.7, respectively. At a given level of creep strain and volume fraction reinforcement dislocation configurations and density in the aluminum matrix are independent of distance from the interface. In effect, the dislocation substructure is independent of volume fraction reinforcement and is controlled solely by the creep strain in the matrix. Author (TAB)

N70-32353# United Aircraft Corp., East Hartford, Conn. Research Labs.
EFFECT OF EUTECTIC MICROSTRUCTURE ON THE PROPERTIES OF CERAMIC OXIDES Technical Report, 1 Feb. 1969–31 Jan. 1970
Charles O. Hulse and John A. Batt 16 Mar. 1970 38 p refs
(Contract N00014-69-C-0073)
(AD-704173; TR-1; J910803-3) Avail: CFSTI CSCL 11/2

A general survey was made of ceramic eutectics which involved making castings and metallographic examinations on twenty-nine different systems. Four different pieces of unidirectional solidification equipment which were constructed during this period or are in the latter stages of development are described. Information is included from thirty unidirectional solidification experiments. Most of these runs employed alumina tubes to contain eutectic melts which solidified below 1000C. In order to obtain high thermal gradients, these tubes were slowly lowered into a water bath which extended well into the furnace. It was observed with some eutectic systems that after about 1/2 in. of solidification, bubbles could be nucleated and porous ingots obtained. This problem was overcome either by inserting a high frequency vibrating probe into the liquid during solidification or by creating a vacuum over the melt before solidification. In order to avoid the complications due to impurity

pickup from oxide containers, later solidification experiments were conducted in platinum. A composite crucible was developed for this purpose which consisted of a plasma sprayed coating of mullite on the outside of a platinum crucible. Upon cooling, the low thermal expansion of the mullite restricted the thermal expansion of the platinum bonded to it. This allowed ingots to be removed intact from the crucible while the platinum was clean and undamaged. Author (TAB)

N70-32424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NOVOCHERKASSK POLYTECHNIC INSTITUTE TRANSACTIONS: SELECTED ARTICLES
D. T. Avdeev et al 27 Feb. 1970 92 p refs Transl. into ENGLISH from Tr. Novocherk. Politekhn. Inst. (Novocherkassk), v. 177, 1967 p 11–14, 23–35, 39–46, and 50–79
(AD-704771; FTD-MT-24-391-69) Avail: CFSTI CSCL 11/8

Contents: Investigation of static friction of caprone on steel; Structure and antifriction properties of low-pressure polyethylene depending on two methods of mixing with mineral oil; The investigation of graphitoplast for friction and wear in lubrication with water; Comparative investigations of friction of rest of certain plastics with large specific loads; Determining pressure in a high polymeric mass during rolling; Antifriction properties and wear resistance of polyamide resins with a graphite filler in lubrication with water; Comparative investigation of the friction of steel and plastic samples under the effect of shock loads; Investigating the effect of certain types of corrosion inhibitors and anticorrosive coverings on the wear-resistance of a steel-polyamide friction pair with operation in water; Certain questions concerning the friction of plastics based on polyamide resins with a filler with water lubrication; and The investigation of the wear resistance of certain polymers during operation in water. TAB

N70-32438# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-MELTING LUBRICANTS BASED ON COMPLEX CALCIUM SOAPS OF COMMERCIAL SYNTHETIC FATTY ACIDS
M. B. Nakonechnaya et al 25 Sep. 1969 14 p refs Transl. into ENGLISH from the Publ. "Neftepererabotka i Neftekhimiya" Kiev, Naukova Dumka, 1967, p 114–119
(AD-700400; FTD-MT-24-170-69) Avail: CFSTI CSCL 11/8

Synthetic fatty acids can be used in the production of high-quality complex calcium lubricants which can be used in a wide range of temperatures. The best calcium lubricants are obtained when using the wide heat-treated and distilled fraction of acids C10-C20 which does not contain acids higher than C20. Based on volumetric and mechanical properties and the results of bench tests, the complex synthetic calcium lubricants essentially surpass contemporary lubricants of ordinary assignment: solid lubricants, konstalin, 1-13, and others. They can find wide application in the national economy as a universal lubricant. Author (TAB)

N70-32462# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBINED ACTION OF TSIATIM-339 AND SULFONATE ADDITIVES ON THE PERFORMANCE OF PROPERTIES OF DS-11 OIL
A. M. Bugaichuk et al 12 Mar. 1970 9 p refs Transl. into ENGLISH from Neftepererabotka i Neftekhimiya (USSR), no. 3, 1969 p 21–23
(AD-705163; FTD-HT-23-143-70) Avail: CFSTI CSCL 11/8

Preliminary testings of the DS-11 oil with a composition of additives consisting of five parts by weight of TsIATIM-339 (chemical abstracts 60: 1512f, 13076d) and one part by weight of the sulfonate additive on engine 4Ch 10.5/13 indicated that the lubricating oil obtained possesses superior operational properties. In order to determine the possible range of application of this lubricating oil it is necessary to study its behavior in diesel engines of different types under conditions of prolonged operation. Author (TAB)

N70-32454 European Organization for Nuclear Research, Geneva (Switzerland).
THE EFFECT OF IONIZING RADIATION ON EPOXY RESINS [ACTION DES RADIATIONS IONISANTES SUR LES RESINES EPOXYDES]
M. H. Van de Voorde 1970 101 p refs In FRENCH
(CERN-70-10) Copyright. Avail: Issuing Activity

The radiation resistance of epoxy resins is considered. Irradiation sources and dosimetry techniques are described. The structure, after irradiation, of the epoxy resins and the hardeners is also considered indicating the physical properties. The influence of irradiation conditions on the epoxide resins and the relations between the chemical structures of the resins is studied. Transl. by J.M.C.

N70-32475 National Lending Library for Science and Technology, Boston Spa (England).
A METHOD FOR MEASURING FRACTURE PROPAGATION VELOCITIES ON FRACTURE SURFACES [VERFAHREN ZUR MESSUNG VON BRUCHFORTPFLANZUNGS-GESCHWINDIGKEITEN AN BRUCHFLAECHEN]
A. Smekal 28 Nov. 1969 26 p refs Transl. into ENGLISH from Glastech. Ber. (Frankfurt am Main), no. 23, 1950 p 57–67 Presented at the 23d Glass Technol. Meeting, Munich, 24 May 1949
(NLL-M-7951-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The method of determining propagation velocity in glassy materials is based on measurements of two intersecting sets of curved lines upon the flat regions of bending and tensile fracture surfaces. These lines are identified as tracks left by three dimensional praetersonic waves with frequencies up to 10 GHz. The surfaces of cylindrical test rods are ground or etched, and tiny sites with internal elastic stresses are formed. As a result of tensile loading, stress peaks are produced at the sites, and the most active sites determine the fracture and the ultrasonic trace origins. The techniques used in interpreting the lines are described. N.E.N.

N70-32499*# Boeing Co., Seattle, Wash. Aerospace Group.
PROTON AND ELECTRON EFFECTS IN THERMAL CONTROL MATERIALS Final Report
Lawrence B. Fogdall and Sheridan S. Cannaday May 1970 96 p refs
(Contract NAS5-11219)
(NASA-CR-110715) Avail: CFSTI CSCL 11C

The effects of 35 keV electrons and 40 keV protons on the reflectance and degradation properties of selected specular and diffuse thermal control materials tested at room temperatures were studied and compared. FEP Teflon, Alzak, Kapton, and diffuse white paints were emphasized. Reflectance measurements between 0.24 and 2.54 microns wavelength were made on test specimens at various exposure levels. Plots of reflectance properties of the materials as a function of wavelength were obtained by computer processing of test data, and the results are presented. Comparison of the proton and electron exposure results shows four different types of spectral reflectance degradation characteristics in the 18 types of materials tested in both particle environments. Plots showing the damage classifications are included, and coatings offering best solar absorptance stability are identified. A coating temperature study, a proton energy study, combined particle-ultraviolet radiation studies, and in situ capability for coating emittance measurements following exposure to charged particles are recommended for future effort and understanding. Author

N70-32590# Army Foreign Science and Technology Center, Washington, D.C.
EFFECT OF IONIZING RADIATION ON WOOD AND ITS COMPONENTS
V. N. Sergeeva et al 3 Mar. 1970 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv.SSR, Ser. Khim. (Riga), no. 4, 1968 p 481–487
(AD-703573; FSTC-HT-23-143-70) Avail: CFSTI CSCL 11/12

The effect of low doses of ionizing radiation on the properties of elementary spruce wood fibers, viz., cellulose, holocellulose, and cellolignin, was studied. Gamma doses were 10, 30, 50 and 70 Mrad at a radiation power of 600 rad/sec. Variation in properties after irradiating fibers was determined by their degree of swelling in a sulfuric acid-glucose solution. A 10 Mrad dose destroyed hemicellulose and, particularly, cellulose in wood. Under these radiation conditions, fibers not containing lignin, cellulose and hemicellulose underwent considerably deeper destruction. Consequently, lignin exhibits protective action against radiation. In turn, lignin under the effect of gamma rays varies more sharply in cellolignin than in wood. At 50- and 70-Mrad doses, the primary tertiary walls of cellolignin fiber undergo marked destruction.
Author (TAB)

N70-32601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTROSCOPIC STUDY OF PROCESSES ON THE SURFACE OF GLASS FIBERS DURING FINISHING
V. I. Alksne et al 20 Mar. 1970 10 p refs Transl. into ENGLISH from Mekh. Polim. (Latvia SSR), no. 1, 1968 p 182–185
(AD-704769; FTD-MT-24-377-69) Avail: CFSTI CSCL 7/4

IR spectroscopy has shown that during the finishing of glass fiber by beta-cyanoethyltriethoxysilane on the surface of the fiber in the process of its treatment there is hydrolysis of the nitrile group and carboxyl radicals appear. This process is spectroscopically seen by the disappearance of the nitrile band and the appearance of a carbonyl band in the spectrum.
Author (TAB)

N70-32623# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ADHESION OF THERMOPLASTIC AND THERMOREACTIVE POLYMERIC BONDING AGENTS TO ORGANIC FIBERS
A. I. Kurilenko et al 15 Jan. 1970 11 p refs Transl. into ENGLISH from Nauchn. Konf. po Fiz.-Khim. Mekh. Poristykh i Voloknistykh Dispersnykh Strucktur i Materialov, Riga, 1965 (USSR), 1967 p 299–303
(AD-704839; FTD-MT-24-321-69) CSCL 11/1

The dependence of adhesion on conditions of paste preparation and the effect of polymer properties on the adhesion were studied. Viscose (Rayon), Kapron (Nylon), Lavsan (Dacron), polystyrene (I), polypropylene (II), and ftorlon fibers were investigated. Binders were thermoreactive resins ED-5, MGF-9, and PN-1, thermoplastic polymers Kapron, poly[vinyl alc.] (III), I, polyethylene (IV), and ftorlon, and latex SKN-40-1GP with metazin. The adhesive strength did not depend on the concentration of I in the solution and on the period of heating through. Adhesion of I to PVC fibers of various elasticities had practically the same values. Adhesion of IV (surface tension 31 dynes/cm.) to glass fiber and lavsan was 50 to 20 kg/sq cm respectively. Mol. adsorption nature of forces of adhesive linkage of polymers is suggested.
TAB

N70-32639# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
ESTIMATION OF THE AMORPHOUS COMPONENT IN PYROLYTIC CARBON WITH THE HELP OF AN OPTICAL METHOD, PART 1 [ABSCHAETZUNG DES AMORPHEN ANTEILS IN PYROKOHLENSTOFF MIT HILFE EINER OPTISCHEN METHODE, TEIL 1]
K. Kolzlik, H. A. Schulze, H. B. Gruebmeier, and G. P. Scheidler
Apr. 1969 22 p refs In GERMAN; ENGLISH summary
(Jul-589-RW) Avail: CFSTI

The orientation anisotrophy of pyrolytic carbon layers on nuclear fuel elements was determined by optical photometric reflection measurements in correlation with the anisotropy factor found by X-ray analysis. This correlation is enlarged by encompassing pyrolytic deposited carbon layers from amorphous as well as crystalline carbon; the amorphous component is then obtained by the optically determined anisotropy factor of the combined measurements.
Transl. by G.G.

N70-32776# Naval Postgraduate School, Monterey, Calif. Dept. of Material Science and Chemistry.
VERIFICATION OF MODEL OF MOLTEN GLASS FLOW IN A FOREHEARTH
Sina Pekcelen (M.S. Thesis) Dec. 1969 61 p refs
(AD-704524) Avail: CFSTI CSCL 11/2

Variations on velocity profiles in a flowing mass of molten glass in a forehearth are investigated. Formerly used parabolic velocity profiles are replaced with analytical solution of open channel flow equation, based on the available data on mass flow of molten glass through the channel in unit time. Concerning the viscosity effects; temperature dependence of viscosity is built in the model. However, it is assumed that the depth of the channel does not effect the viscosity gradients. To solve the system of non-linear differential equations i.e., heat equation and flow equation; the analytical solution of the latter at the nodes is used for the numeric solution of the former iteratively, until the convergence is obtained. Predicted temperatures are compared to the available data from an actual operating forehearth, and against the results predicted by the previous model using simplying assumptions to prove its validity.
Author (TAB)

N70-32783# Naval Postgraduate School, Monterey, Calif. Dept. of Operations Analysis.
A STATISTICAL STUDY OF SPECTROMETRIC OIL ANALYSIS DATA FROM THE NAVAL OIL ANALYSIS PROGRAM
John Patrick Riceman (M.S. Thesis) Oct. 1969 88 p refs
(AD-704522) Avail: CFSTI CSCL 11/8

The thesis examines spectrometric oil analysis data from two sources in an attempt to formulate a statistical model which will be useful in monitoring aircraft engines in the Naval Oil Analysis Program. Initially, experimental data, gathered for an Air Force study, was used to determine if the measurement error inherent in the monitoring procedure is normally distributed and if correlations exist between measurements for different wear metals. Based on the results of this investigation, a study was made of operational data from Wright reciprocating engines of the R1820-82 type. The investigation leads to the conclusion that a multivariate regression model is useful in estimating the parameters of the distribution of analyses from properly operating engines of this type. A procedure is suggested which would employ the readings from past oil analyses from a particular engine to determine its present condition.
Author (TAB)

N70-32811 National Lending Library for Science and Technology, Boston Spa (England).
X-RAY INVESTIGATION OF STRUCTURAL CHANGES IN GRAPHITE ANTIFRICTION MATERIALS DURING FRICTION
10 Feb. 1970 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr. (Moscow), no. 4, 1963 p 179–184
(NLL-RISLEY-Trans-1850-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A commercial grade material was used which was made by compacting a uniform mixture of oil coke, natural graphite, and coal tar pitch with oil as the binder. The material was subjected to a friction test using a rotating steel roller and the specific

pressure was raised in stages up to the value at which there was intensive wearing of the graphite accompanied by the formation of large amounts of wear products. The powder wear products of the graphite material were packed into film capillaries and used as test specimens. The X-ray studies show a considerable degree of azimuthal disorder and mutual displacement of the crystal layers. The test results are compared with data from earlier tests. R.B.

N70-32835# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.

ARPA-NBS PROGRAM OF RESEARCH ON HIGH TEMPERATURE MATERIALS AND LASER MATERIALS, 1 JULY - 31 DECEMBER 1969

A. D. Franklin and H. S. Bennett, eds. Jun. 1970 77 p refs Sponsored by ARPA

(NBS-TN-531) Avail: SOD $0.70

Brief reviews are given of work performed during the period July 1 to December 31, 1969, on a number of projects concerned with high temperature materials and with laser materials. Under the high temperature materials heading, topics include diffusion of oxygen in oxides, growth of Al2O3 crystals by chemical vapor deposition, the electronic structure of transition metal borides and related compounds, the optical constants of titanium, high temperature creep in copper, and the mechanism of volatilization of polymers and long-chain compounds. Work on laser materials includes measurement of bulk optical and elastic properties of laser materials, a study of the orange degradation of ruby, measurements of subcrystal misalignment in ruby, damage in glass induced by high-energy laser pulses, chemical analyses for ruby and Nd-doped laser glasses, and preliminary studies on detection of submicroscopic inhomogeneities in glass. Author

N70-33003# Oak Ridge National Lab., Tenn.

MINIMIZING THERMAL EFFECTS IN FLUIDIZED BED DEPOSITION OF DENSE ISOTROPIC PYROLYTIC CARBON

R. L. Beatty, J. L. Scott, and D. V. Kiplinger Apr. 1970 30 p refs

(Contract W-7405-eng-26)

(ORNL-4531) Avail: CFSTI

High-density isotropic pyrolytic carbon coatings on ceramic fuel microspheres can be deposited from propane at much lower temperatures and at higher rates than from methane, but the high heat capacity and heat of formation of propane would complicate heat supply to a large-scale coater. Deposition from propane and propene (which has smaller heat requirements) at 1150 to 1300 C with fluxes varied by dilution with helium were compared. Either gas undiluted gave coatings denser than 2.0 g/cm3 at 1250 C at 10 micrometer/min. Propyne and propadiene gave similar coatings more rapidly, and with no heat requirement, but the range of conditions was limited by the instability of these gases, and the coatings were less dense than those derived from propane or propene under similar conditions. Author (NSA)

N70-33008# Sandia Corp., Livermore, Calif.

PROPERTIES OF PALARITE THERMAL INSULATION

T. J. Weber Apr. 1970 26 p refs

(Contract AT(29-1)-789)

(SCL-DR-69-150) Avail: CFSTI

Palarite, a low-density, low thermal conductivity material developed for good machinability, is described and characterized. The data are presented as a guide to preliminary engineering. Author (NSA)

N70-33047# Georgia Univ., Athens. Dept. of Physics.

INFRARED SPECTRA OF PLASTICS AND ELASTOMERS AFTER NUCLEAR IRRADIATION Final Research Report, 1 Jan. 1959 - 30 Jun. 1969

W. C. Sears 30 Aug. 1969 117 p refs

(Contract AT(40-1)-2418)

(ORO-2418-7) Avail: CFSTI

Studies were made on the changes in molecular structure produced by high-energy radiation on different organic polymers, and also on the mechanism of radioinduced growth and decay of unsaturation and changes in polymer crystallinity, crosslinking, and scission. The structural changes were determined by measuring the IR spectra of polymer films with a Beckman IR-4 infrared spectrophotometer before and after irradiation. Gamma dose rates varied from 1,300,000 to 5,400,000 R/hr. Data are presented in tabular and graphic form. NSA

N70-33069# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

RADIATION HARDENING COMPOSITIONS IN THE COLD FOR COATINGS OR OTHER APPLICATIONS [COMPOSITIONS RADIODURCISSABLES A FROID POUR REVETEMENTS OU AUTRES APPLICATIONS]

M. F. Blin and G. Gaussens [1969] 25 p refs In FRENCH Presented at the Symp. on the Util. of Large Radiation Sources and Accelerators in Ind. Process., Munich, 18 - 22 Aug. 1969

(CEA-CONF-1413; CONF-690805-8) Avail: AEC Depository Libraries

Reticulation or reticulating grafting of mixtures of monomers and polymers by accelerated electrons was studied by working with solutions of very variable composition both with respect to the nature of the monomers and polymers and the monomer/polymer ratio. The reticulation reactions are the basis of phenomena that transform certain varnishes, paints, and coatings to hard insoluble products having an improved chemical stability. The coatings are applied on a support and reticulated on them by irradiation with an intense beam of accelerated electrons. Three types of polymers were studied: linear polyesters, modified epoxydic polymers, and polyacrylics. It was thus possible to show the effect of different parameters - dose between 1 and 2 Mrad, dose output between 0.008 and 1.7 Mrad/sec, reactivity of the monomer/polymer mixture, and oxygen of the air - on the rate of formation of the gel. In addition to its rapidity of action, the procedure using the action of radiation for the hardening of coatings can be applied to articles of every nature and avoids their alteration in the case of woods, cement coatings, concretes, plaster coatings, plastic coatings, paper, and leather. The treatment is done at room temperature. Author (NSA)

N70-33133# Gulf General Atomic, San Diego, Calif.

RESEARCH ON GRAPHITE Quarterly Progress Report, Period Ending 14 Feb. 1970

G. B. Engle, J. C. Bokros, and R. J. Price 26 Feb. 1970 18 p refs

(Contract AT(04-3)-167)

(GA-9968) Avail: CFSTI

Needle-coke graphites expanded up to 50 vol % when irradiated to 1.5 × 10 to the 22nd power n/sq cm at 1175 to 1280 C, whereas expansion of near-isotropic materials ranged up to 20%. Irradiation of a number of graphite specimens at 1000 C to 3 × 10 to the 21st power n/sq cm followed by irradiation at 760 to 800 C to 5 × 10 to the 21st power n/sq cm showed no reduction in the rate of dimensional change over other specimens irradiated to 5 × 10 to the 21st power n/sq cm at 1000 C. Thermal expansivities of near-isotropic graphites were reduced, whereas those of needle cokes either remained unchanged or increased during irradiation. The changes were correlated with structural features of the materials. Large pores were observed micrographically in the graphites that expanded at high fluences. Changes in dimensions, thermal expansivity, and X-ray diffraction parameters were measured. Dimensional changes of graphite specimens irradiated in Dragon at 975 to 1240 C to 0.9 to 2.4 × 10 to the 21st power n/sq cm compared favorably with data from the ETR experiments. Author (NSA)

N70-33138*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MECHANISMS OF RECOVERY OF RADIATION DAMAGED SILICATE-TREATED ZINC OXIDE THERMAL CONTROL COATINGS
J. A. Colony and J. A. Bass Jun. 1970 16 p refs
(NASA-TM-X-63965; X-713-70-251) Avail: CFSTI CSCL 11C

X-ray exposure of a silicate-treated zinc oxide coating results in a drastic reduction of near infrared reflectance. This damage is completely reversible upon exposure to an oxygen environment as is the case for ultraviolet induced damage in coatings made from untreated zinc oxide. Thus, damage in both cases is due to loss of oxygen from the zinc oxide crystals. The rapid increase in bleaching rate with increase in temperature is due to an accelerated diffusion rate of molecular oxygen through the silicone binder as well as to possible increased kinetics of reaction of oxygen molecules with damaged pigment. Oxygen photolysis due to ultraviolet exposure during bleaching results in a suppression of bleaching rate. This is due to interaction of atomic oxygen with the methyl silicone binder which creates a barrier for diffusion of molecular oxygen. Comparisons between bleaching effects of the coating and of the treated pigment alone indicate consistent relative behavior as a function of environment. The mechanisms of damage and recovery, then, must be unaffected by the silicone binder. Author

N70-33149# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALL-UNION CONFERENCE ON GLUES AND GLUING TECHNOLOGY: SELECTED ARTICLES
N. A. Medvedeva et al 5 Mar. 1970 35 p refs Transl. into ENGLISH from Tr. Vses. Konf. po Kleiam i Tekhnol. Skleivaniya (USSR), 1966 35 p
(AD-704841; FTD-MT-24-373-69) Avail: CFSTI CSCL 11/1

Contents: Optical glues on a epoxidepolyester resin base; Use of adhesives in the manufacture of plastic-coated metals; and Increasing the adhesion of polyethylene to metals. TAB

N70-33371# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERACTION OF ELECTRONS OF AVERAGE ENERGIES WITH THIN THERMOPLASTIC LAYERS
N. G. Nakhodkin et al 6 Mar. 1970 16 p refs Transl. into ENGLISH from Zh. Nauchn. i Prikl. Fotogr. i Kinematogr. (Moscow), v. 13, no. 2, 1968 p 122–127
(AD-704848; FTD-MT-24-427-69) Avail: CFSTI CSCL 11/9

In the article an attempt is made to study the processes of charging of rosin of different thickness in the 1-15 micrometers range at different energies of electron beam, and also to explain how these parameters influence the depth of the geometrical relief of recording. TAB

N70-33387# United Kingdom Atomic Energy Authority, Harwell (England). Progress Technology Div.
SOME MECHANICAL PROPERTIES OF CARBON FIBRE COMPOSITES
H. Wells, W. J. Colclough, and P. R. Goggin Jul. 1969 53 p refs Presented at Reinforced Plastics Conf., Soc. of Plastics Ind. Inc., Feb. 1969
(AERE-R-6149) Avail: AEC Depository Libraries

Results of experiments are reported which indicate that given improvements in the technology of composite manufacture such as tow or tape winding, and the preparation of sheet material to achieve more precise filament orientation, materials can be produced with mechanical properties which will agree substantially with those predicted by micromechanics. Some of the methods of tests currently used will have to be reexamined when used with carbon composites. High performance resins are likely to attract increasing attention because of the increase in transverse properties notably the elastic constants and possibly in impact resistance. Glass fiber resin composites are now universally accepted as high strength structural materials. This is because of improvements in glass fiber resin systems and coupling agents; it is also because workers in many countries have contributed to a better understanding of the strength characteristics of duplex materials. Author (NSA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-32007# California Univ., Los Angeles. Western Management Science Inst.
CONDITIONAL MONTE CARLO: A SIMULATION TECHNIQUE FOR STOCHASTIC NETWORK ANALYSIS
John M. Burt, Jr. and Mark B. Garman Feb. 1970 28 p refs
(Contract N00014-69-A 0200-4005; Grant NSF GS-2041)
(AD-703653; WMSI WORKING PAPER-157) Avail: CFSTI CSCL 12/2

The paper is concerned with a simulation procedure for estimating the distribution functions of the time to complete stochastic networks. The procedure, called conditional Monte Carlo, is shown to be substantially more efficient (in terms of the computational effort required) than traditional simulation methods. The efficacy of conditional Monte Carlo and its use in conjunction with other Monte Carlo methods is illustrated for the Wheatstone bridge network. The applicability of the procedure to larger networks, as well as other stochastic systems, is discussed and a general method is given for its implementation. Author (TAB)

N70-32008# California Univ., Irvine. Dept. of Mathematics.
THE ALGEBRAIC INVARIANCE OF THE WORD PROBLEMS IN GROUPS
Frank B. Cannonito 19 Oct. 1969 18 p refs
(Grant AF-AFOSR-1321-67)
(AD-704130; AFOSR-70-0920TR) Avail: CFSTI CSCL 12/1

A study of conditions on classes of recursive function sufficient to insure the algebraic invariance of the work problem in finitely generated (f.g.) groups, that is, conditions such that for all f.g. presentations the algorithm solving the word problem resides in the same class. Several proposed classes satisfying these conditions are given and examples of finitely presented groups having word problems for these classes are constructed. TAB

N70-32009# California Univ., Berkeley. Operations Research Center.
ON INTEGRALS OF A CLASS OF MEASURABLE FUNCTIONS
Harold L. Stalford and George Leitmann Feb. 1970 13 p refs
(Contract N00014-69-A-0200-1012; Grant NSF GP-15473)
(AD-703651; ORC-70-3) Avail: CFSTI CSCL 12/1

An integral is evaluated whose integrand is nonnegative, measurable, and possesses the property of being integrable over closed intervals contained in an open dense subset of the interval of integration, where this open dense subset is the complement of a countable closed subset of the interval of integration. Applications to control theory and differential game theory, where these integrals were first used, are mentioned. Author (TAB)

N70-32014# California Univ., Irvine. Dept. of Mathematics.
EMBEDDINGS OF PRIMITIVE RECURSIVE COMPUTABLE GROUPS
Ronald Wallace Gatterdam (Ph.D. Thesis) 30 Jan. 1970 100 p refs

(Grant AF-AFOSR-1321-67)
(AD-703757; AFOSR-70-0904TR) Avail: CFSTI CSCL 12/1

The purpose of the paper is to show that the Higman embedding preserves primitive recursive computability. More generally it is shown that for A, a recursively enumberable subset of the natural numbers and G, and A-primitive recursive computable group G can be embedded as an A-primitive recursive decidable subgroup of a finitely presented, A-primitive recursive computable group. Author (TAB)

N70-32018# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
A COMPUTER BASED SEARCHABLE FILE OF JOURNAL REFERENCES IN THE FIELD OF PARTIAL DIFFERENTIAL EQUATIONS
George C. Francis Feb. 1970 22 p refs
(AD-703877; BRL-MR-2025) Avail: CFSTI CSCL 5/2

A computer was programmed to prepare a searchable and updatable magnetic tape file of journal references in the field of partial differential equations. Multiple simultaneous queries involving Boolean logic are permitted and were used in automatic indexing of the file prior to publication of a first version. Search strategies are partially self-organizing. Examples of program use are included in the report. Author (TAB)

N70-32026# California Univ., Berkeley. Operations Research Center.
THE JOINT PRODUCTION FUNCTION Research Report
Ronald W. Shephard Mar. 1970 13 p refs
(Contract N00014-69-A-0200-1010; Grant NSF GP-15473)
(AD-704081; ORC-70-10) Avail: CFSTI CSCL 5/3

A Joint Production Function is a mathematical expression defining for a technology the set of alternative input vectors which yield a given output vector and/or inversely defining the set of alternative output vectors obtainable with a given input vector. This notion, useful in economic theory and applied in econometric studies, has not been well formulated nor has a joint production function been shown to exist in the context of a general model of joint production. The research reported on in the paper is first directed to these issues. Secondarily, special forms for homothetic structures are investigated. Author (TAB)

N70-32036# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
SOME EMBEDDING THEOREMS FOR GENERALIZED SOBOLEV SPACES
Palmer Rodney Schlegel Mar. 1970 57 p refs
(AD-704700; BRL-1479) Avail: CFSTI CSCL 12/1

The paper contains the detailed proofs of the collection of some embedding theorems for generalized Sobolev spaces as given in a paper by R. D. Meyer. Meyers paper resulted from a study of a partial differential operator which is elliptic on the interior of a closed bounded region Omega of the n-dimensional Euclidean space R sup n, and degenerates on the boundary of Omega. Thus one is led to study the functions in the spaces described in this paper. The first chapter of the paper presents the notation, the definitions of the various spaces and some elementary properties of generalized derivatives in the sense of Sobolev. Chapter II examines the embedding theorems of the spaces defined in Chapter I. Finally, Chapter III considers a result which is analogous to the Hahn-Banach theorem, that is, a norm bounding extension. Author (TAB)

N70-32050*# Techtran Corp., Glen Burnie, Md.
APPLICATION OF THE LAPLACE TRANSFORMATION TO THE SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS WITH VARIABLE COEFFICIENTS [PRIMENENIYE PREOBRAZOVANIYA LAPLASA DLYA RESHNIYA LINEYNYKH DIFFERENTSIAL'NYKH URAVENENIY S PEREMENNYMI KOEFFITSIYENTAMI]
A. G. Shevelev Washington NASA Jul. 1970 21 p refs Transl. into ENGLISH from Ukr. Mat. Zh. (Ukraine SSR), v. 21, no. 5, 1969 p 640–652
(Contract NASw-2037)
(NASA-TT-F-13095) Avail: CFSTI CSCL 12A

Application is made of Zadeh's form of the Laplace transform to the solutions of ordinary differential equations with variable coefficients. The solutions are treated as displaced functions. Representations of differential equations with variable coefficients and representations of integral and integrodifferential equations are obtained. The solution of these equations is obtained by elementary operations. Author

N70-32066# Carnegie-Mellon Univ. Pittsburgh, Pa. Dept. of Statistics.
COMPARISON OF CERTAIN SMALL SAMPLE POISSON PROBABILITY ESTIMATES Technical Report, Mar. 1969
Donald P. Gaver, Jr. and David G. Hoel (Westinghouse Res. Labs.) Mar. 1969 35 p refs
(Grants NSF GP-6296; NSF GP-8824)
(TR-27) Avail: Issuing Activity

The statistical estimation of the tail of the exponential distribution or equivalently the zero term of the Poisson probability distributions, r = e to the minus lambda x is discussed. Interest in this probability is aroused by its frequent invocation to describe the reliability of a piece of equipment,i.e. the probability that the equipment (at times a component, subsystem, or system) will survive without failure throughout a period of duration x. In the reliability context the parameter lambda(lambda >O) in the equation represents the (constant) failure rate. As basis for estimating r it is supposed that a record of past events over a fixed time t is available and denote the number of events (e.g. failures) therein by N (t). Under the initial assumption of stationary Poisson failures the small-sample (finite observation time, t) properties of various alternative estimators of r are studied. Among these are the maximum likelihood estimates. Comparison is based on the bais and mean-squared errors of the various estimates, and is carried out numerically. Going further, we introduce A model is introduced to rationalize the pooling of data from similar situations (e.g., from different system copies). Author

N70-32080# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
MULTIVARIATE GAMMA DISTRIBUTIONS GENERATED BY MIXTURE
Donald P. Gaver, Jr. Apr. 1969 7 p refs
(Grant NSF GP-8824)
(TR-30) Avail: Issuing Activity

A family of bivariate and multivariate exponential and gamma distributions is constructively generated. From the actual construction infinite divisibility properties become evident. Certain generalizations are mentioned. Author

N70-32084 Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
RELATIONS BETWEEN PITMAN EFFICIENCY AND FISHER INFORMATION
M. H. De Groot and M. Raghavachari Jul. 1969 11 p refs
(Grant NSF GP-8824)
(TR-34) Avail: Issuing Activity

Some fundamental relations are presented between between the efficacy of a test statistic for any finite sample and the information in the statistic. Close relations are developed between Pitman efficiency and Fisher information that throw new light on the meaning of these concepts. Author

N70-32089# California Univ., Irvine. Dept. of Mathematics.
TWO CONJUGATE PRIMITIVE RECURSIVE PERMUTATIONS NOT CONJUGATE BY A PRIMITIVE RECURSIVE PERMUTATION
Mark Finkelstein 15 Jun. 1969 8 p refs
(Grant AF-AFOSR-1321-67)
(AD-704131; AFOSR-70-0933TR) Avail: CFSTI CSCL 12/1

The purpose of the paper is to demonstrate that a program of research to carry group-theoretic analysis of conjugacy classes over to the fine structure of the Grzegorczyk hierarchy cannot be carried out. This is established by the exhibition of two primitive recursive permutations which are conjugate, and yet their conjugating element is not primitive recursive. Author (TAB)

N70-32139# Naval Postgraduate School, Monterey, Calif.
AN APPLICATION OF THE POPOV STABILITY CRITERION TO THE DESIGN OF NONLINEAR SYSTEMS
Claus Erwin Zimmermann (M.S. Thesis) Dec. 1969 60 p refs
(AD-705058) Avail: CFSTI CSCL 12/1

A method for nonlinear system design, based on the generalized Popov stability criterion, is developed. It is shown that, although the design method is applicable for all values of q in the Popov theory, it is particularly useful when q is non-zero, since it greatly simplifies the design effort for this case. All designs are accomplished in conjunction with the Nyquist and modified Nyquist loci. Basic to the design procedure is the development and utilization of the modified frequency-response polar loci for lag and lead compensation networks. Three examples, one with digital simulation, are included to illustrate the procedure described. Author (TAB)

N70-32206# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Lab.
DIGITAL GENERATION OF RANDOM SEQUENCES WITH SPECIFIED AUTOCORRELATION AND PROBABILITY DENSITY FUNCTIONS
Nels A. Broste 6 Mar. 1970 19 p refs
(AD-704702; RE-TR-70-5) Avail: CFSTI CSCL 12/1

An algorithm for the digital generation of random number sequences having specified autocorrelation and probability density functions is given. Computations required to set up the algorithm are described. A number of examples illustrate the accuracy and versatility of the procedures described. Author (TAB)

N70-32210# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
A PSEUDO BAYES APPROACH TO DIGITAL DETECTION AND LIKELIHOOD RATIO COMPUTATION
James R. Mc Landon and Andrew P. Sage 5 Dec. 1969 111 p refs
(Contract F44620-68-C-0023)
(AD-703715; AFOSR-70-0604TR) Avail: CFSTI CSCL 9/4

The research investigates the generalized problem of detecting an arbitrary random process in the presence of additive Gaussian noise. The problem is considered in the discrete domain, and computationally feasible algorithms are derived for the likelihood ratio which optimally solves the problem. The likelihood ratio algorithm is expressed as a function of the one state prediction minimum variance estimate of the signal process, suggesting, that the optimum digital detector involves implementation of an estimation algorithm prior to computation of the likelihood ratio. In order to realize algorithms which are applicable to the very general class of problems considered, certain judicious approximations are made. Justifications are given for all such approximations, and the statistical properties of the resulting algorithms are investigated. In addition, several example problems are presented to demonstrate the efficacy of the results. Author (TAB)

N70-32223# Stanford Research Inst., Menlo Park, Calif. Operations Research Dept.
BASIC RESEARCH ON THE STRUCTURE OF NETWORKS, AUTOMATA, AND CONTROL SYSTEMS Final Report, 1 Oct. 1964 - 31 Dec. 1969
R. E. Kalman Mar. 1970 12 p refs
(Contract AF 49(638)-1440)
(AD-703690; AFOSR-70-0881TR) Avail: CFSTI CSCL 12/1

The report describes a five-year (1964-1969) program in algebraic system theory. A list of technical articles published under the contract is included. Author (TAB)

N70-32242# Stanford Univ., Calif. Dept. of Mathematics.
SOME PROBLEMS IN POTENTIAL THEORY
Harold Levine 28 Feb. 1970 26 p refs
(Contract Nonr-225(74))
(AD-703665; TR-16)

Source functions are of importance themselves and also as a means of generating solutions to a variety of field theory problems. The primitive source function which represents a localized excitation (in space and/or time), without reference to limiting surfaces or environmental features that influence the ultimate level of excitation realized, can be employed collectively, as in Kelvins image method, to resolve particular problems for restricted domains of space. A more comprehensive description of geometrical shaping factors is afforded by source functions of the Greens type, which satisfy a specific differential equation, have a localized singularity within the domain and obey one or more boundary conditions on the surface thereof; the purpose of this account is to underscore, with reference to a pair of potential theory investigations hitherto undertaken, the advantages of using Greens functions rather than superposing simple source functions or employing direct integral representation and transform techniques. Author (TAB)

N70-32314# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
SUBJECTIVE RANDOMNESS AND THE CAPACITY TO GENERATE INFORMATION
W. A. Wagenaar 1969 13 p refs
(IZF-1969-27; TDCK-54652) Avail: CFSTI

Literature concerning randomization tasks contains contradictory results since both increases and decreases of nonrandomness have been reported as a function of the response rate. It is proposed that the contradictory results are attributable to differences in experimental procedure and the different mathematical definitions of objective randomness. In an experiment test subjects randomized 2, 3, 4, 6 or 8 alternatives with speeds of 4, 2, 1 and .5 sec. per response. The results showed that there was no significant effect of response rate. There appeared to be substantial individual differences for first- and second-order nonrandomness. Author

N70-32315# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
MULTIPERIOD DECISION MODELS WITH ALTERNATING CHOICE AS A SOLUTION TO THE DUOPOLY PROBLEM
R. M. Cyert and M. H. De Groot Jun. 1969 25 p refs
(Grant NSF GP-8824)
(TR-33) Avail: Issuing Activity

A general solution to the duopoly problem as posed by Cournot is developed. This is a solution to the problem of two firms operating in a market with identical products in which the market demand function is known, each firm knows its own cost function, and decisions are made in alternating periods rather than simultaneously. Furthermore the process is noncooperative; that is, there can be no explicit collusion. The concept of a multiperiod process and sequential decisions as opposed to single periods are discussed first. Next, models of simultaneous choice in a multiperiod

process are considered and some of their shortcomings are discussed. Then a multiperiod process with alternating choice is studied and reaction functions are derived for this process through the method of backward induction. The optimality of this rule is shown for the duopoly problem, and it is established that the reaction functions provide a general solution to the dupoly problem. Author

N70-32325# Grumman Aircraft Engineering Corp., Bethpage, N.Y. System Sciences Section.
OPTIMAL CONTROL PROBLEMS THAT TEST FOR ENVELOPE CONTACTS
H. G. Moyer Jun. 1970 23 p refs Submitted for publication
(RM-479J) Avail: CFSTI

Systems are studied whose state vector is governed by the usual set of first order differential equations. When the extremals that originate at a fixed point in n-dimensional state variable space are stopped at a fixed final time, the locus of their end points defines a hypersurface called the wave front. The well-known adjoint vector is normal to the wave front. The principal point is that a second wave front normal can be constructed from vectors that are available if the test for Jacobi conjugate points is performed. Verifying that the two normals are almost colinear shows that the errors due to computer truncation and numerical integration are negligible. This check is particularly useful when using the finite difference approximation extremals where the extremals are close but nonneighboring. This approximation can simplify considerably the analysis and computation required for a conjugate point test, particularly if the extremals have corners. Author

N70-32348*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
NEIGHBORING OPTIMAL FEEDBACK CONTROL OF MULTI-INPUT NONLINEAR DYNAMICAL SYSTEMS USING DISCONTINUOUS CONTROL
Ronald E. Foerster and I. Fluegge-Lotz Mar. 1970 129 p refs
(Grant NGL-05-020-007)
(NASA-CR-110691; SUDAAR-398) Avail: CFSTI CSCL 12A

The calculation and implementation of the neighboring optimal feedback control law for multi-input nonlinear dynamical systems, using discontinuous control is studied. A derivation of the neighboring optimal control law is described. The neighboring control law is determined by minimizing the second-order terms in the expansion of the performance index about an optimal, nominal path. A distinction is made between real time along the neighboring path and nominal time along the nominal path. The concept of time-to-go is used to choose the nominal time. This concept is applied in two different ways, depending upon whether the terminal time is fixed or free. An open-loop algorithm which determines the number of neighboring switch times, the initial and final control functions, and the most appropriate nominal path, is presented. This algorithm initiates the feedback phase of the mechanization of the neighboring control law. Author

N70-32364# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
A STRUCTURAL TAXONOMY OF SPATIAL HIERARCHIES
Interim Report
Michael J. Woldenberg 24 Mar. 1970 60 p refs *Its* Papers in Theoret. Geography
(Contract N00014-67-A-0298)
(AD-704807; ONR-TR-39) Avail: CFSTI CSCL 12/1

The paper presents a method for the classification of spatial hierarchies (e.g., central places, rivers, blood vessels, airways, trees, etc.). The method is based on the authors mixed hexagonal hierarchy model, which has been slightly amended here. It is possible to classify hierarchies according to a four number framework. The first two numbers, the family and genus, are related to the number of first order areas. The third number or species gives the number of orders; the fourth number is a correction factor which tells whether the hierarchy is complete. A last optional number or parent gives the number of first order areas for a system with one more order. The method can be used to predict new hierarchies and can show close relationships between seemingly different hierarchies. An appendix provides a table of convergent means. Author (TAB)

N70-32390# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
RANDOMNESS
Robert Katz *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 283–301 refs Supported by AEC and NSF (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

Tests were developed to determine whether a particular set of numbers might be produced with good probability by chance alone from a perfectly random generator. Results of a binomial test applied to sets of 500 two-digit numbers formed from a punched card table of random numbers and results of a computer generated set of pseudo-random numbers are presented and compared to Poisson statistical predictions. It was found that roulette decisions seem to be far more nearly random than the table or the computer. Grain sequences observed in photographic emulsion were also tested for their randomness, along with the reader's ability to distinguish between random and nonrandom systems. The applicability of these results to studies of radiation effects is discussed. N.E.N.

N70-32435# Naval Research Lab., Washington, D.C. Security Systems Branch.
THE LIKELIHOOD OF TWO LENGTH-SIX RUNS IN TWENTY TRIALS
Lamont V. Bailey Mar. 1970 30 p
(AD-704469; NRL-MR-2099) Avail: CFSTI CSCL 12/1

The report provides an algebraic solution to the problem of finding the probability that two success runs of length six or greater will occur in a sample of twenty trials when the probability of success on each trial is known. Author (TAB)

N70-32480# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
APPROXIMATION BY POLYGONAL ARCS WITH RESPECT TO EUCLIDEAN NORM
Palmer R. Schlegel Mar. 1970 13 p refs
(AD-704965; BRL-MR-2028) Avail: CFSTI CSCL 12/1

To approximate a given set of data by a polygonal arc with a priori break points by minimizing the Euclidean norm over the class of all such polygonal arcs leads to solving a system of 3n-1 linear equations. In this note the problem is reduced to inverting a tridiagonal, symmetric matrix of order n-1. Author (TAB)

N70-32568*# Stanford Univ., Calif. Dept. of Statistics.
A GENERALIZED UNIMODALITY
Richard A. Olshen and Leonard J. Savage 1 Apr. 1969 24 p refs Sponsored in part by NASA
(Contracts Nonr-225(52); Nonr-609(52))
(AD-687110; NASA-CR-110684; SU-TR-143) Avail: CFSTI CSCL 12A

The paper introduces a definition -- more exactly, a one parameter family of definitions -- of unimodality for random objects taking values in a finite dimensional vector space. The possibility of a more general range space is briefly mentioned, and some special attention is given to the one dimensional case and its connections with ordinary unimodality. Two characterizations, or alternative definitions, of alpha-unimodality are given. One of these is an extension of Khintchines theorem to alpha-unimodality. The other is related to an inequality discovered by Anderson for a type

of unimodality stricter than n-unimodality for an n-dimensional vector space. In more than one dimension, the distribution of an alpha-unimodal vector can be completely singular, but also it can be absolutely continuous. The densities of absolutely continuous alpha-unimodal random vectors are characterized. The notion of alpha-unimodality permits a little to be salvaged from the known disaster that sums of real, independent, unimodal random numbers need not be unimodal. Author (TAB)

N70-32577*# California Univ., Berkeley. Electronics Research Lab.
SLOWLY VARYING DISCRETE SYSTEM x SUB (i+1) = A SUB i x SUB i
C. A. Desoer [1969] 4 p refs
(Grant NGL-05-003-016)
(NASA-CR-110694) Avail: CFSTI CSCL 12A

If all eigenvalues of all matrices A sub i (i = 0, 1, 2, ...) lie in a disk of radius < 1 and if the matrices vary sufficiently slowly, then the system x sub (i + 1) = A sub i x sub i is exponentially stable. An explicit upper bound on the variation rate is given. A result established for the continuous case is proved for the discrete case. Author

N70-32597# Environmental Science Services Administration, Boulder, Colo. Research Labs.
PRESENTATION OF ERRORS OF A FOUR DIMENSIONAL PARAMETER IN A SINGLE PLANE
Heinz H. Grote Dec. 1969 10 p refs
(ESSA-TR-ERL-137-APCL-8) Avail: SOD $0.25

Based on the truth tables for logical algebra, a single plane presentation is given for the errors in a four-dimensional parameter. Instead of the two levels in logical algebra the output function can assume any value of the number scale. Iso-error lines can be drawn. An extension to three input levels is possible. Author

N70-32627# Pennsylvania Univ., Philadelphia. The Moore School of Electrical Engineering.
A SOLUTION OF THE SYNTACTICAL INDUCTION-INFERENCE PROBLEM FOR A NON-TRIVIAL SUBSET OF CONTEXT-FREE LANGUAGE. Interim Technical Report
Tsyh-Wen Lee Pao Aug. 1969 132 p
(Contract DA-31-124-ARO(D)-98; GRANTS NSF GP-5661; PHS-GM-13494-01)
(AD-702963; AROD-4166.20-M; Rept-70-19) Avail: CFSTI CSCL 5/7

The inference problem is formulated in the form of the following questions: (1) Suppose that one is given a certain finite subset X of sample sentences in a language L, and some cues C (if necessary) and that one is allowed to test whether a certain finite number of strings yi are contained in L. Is it possible to construct a grammar of the language L from this much information. (2) How does one choose X, C and yi in order that the problem in (1) be solvable. (3) If the problem (1) can be solved, can one have an algorithm for the construction of L. This problem is considered in the case of finite state languages. The method of solving the problem for finite state languages is then extended to a non-trivial subclass of context-free languages, which are called delimited languages. Author (TAB)

N70-32660# Naval Postgraduate School, Monterey, Calif.
ON THE UNRECOGNIZABILITY OF SETS
Ronald Barry Knode (M.S. Thesis) Jun. 1969 42 p refs
(AD-703654) Avail: CFSTI CSCL 12/1

Many of the results achieved concerning regularity or non-regularity of sets have been done in the context of equivalence relations of finite index and a fundamental lemma concerning the way certain input can be separated. Recently Marvin Minsky and Seymour Papert developed a set of criteria for non-regularity based on a limiting quantity which seems intuitively to represent the portion or percentage of strings that are in the regular set. In this paper we define for regular sets, in terms of natural Markov processes, another quantity, p(A), which, generally speaking, again represents a kind of percentage of strings in the regular set and show that, when Minskys limits exist, these two quantities agree. From the quantity developed in this paper, however, more information can be gathered concerning the machine which recognizes the regular set (and hence information about the regular set itself) than can be gathered from Minskys criteria. Also described is a special machine which gives an upper bound for the growth rate of sets recognizable by a certain type of automaton. Finally it is shown that the set of well-formed trees written as strings is not a regular set. Author (TAB)

N70-32680# Stanford Univ., Calif. Dept. of Operations Research.
INVARIANT IMBEDDING AND NONLINEAR FILTERING WITH WHITE NOISE IN THE PLANT
James T. Lo 1970 7 p refs Presented at the 4th Ann. Princeton Conf. on Inform. Sci. and Systems, 26-27 Mar. 1970
(Contract DA-31-124-ARO(D)-394; Grants AF-AFOSR-1898-70; AF-AFOSR-1244-67B)
(AD-704603; AFOSR-70-1093TR) Avail: CFSTI CSCL 12/2

The filtering problem of a noisy nonlinear signal process described by a vector stochastic differential equation and a noisy nonlinear observation process of which the statistics of the noise are unknown are considered. The least squares filtering equations are obtained through the idea of invariant imbedding and the application of stochastic differential calculus. Author (TAB)

N70-32724# California Univ., Livermore. Lawrence Radiation Lab.
COMPOSITION OF HERMITE INTERPOLATORY ROOTFINDING ALGORITHMS
Alan C. Hindmarsh 1 Dec. 1969 27 p refs
(UCRL-50771) Avail: CFSTI

The composition of Hermite interpolatory rootfinding algorithms is discussed. The investigation of Hermite interpolarity iteration functions (HIF) consisted of the following actions: (1) deriving an associated polynomial for an arbitrary composite HIF, (2) showing that the reciprocal of a root of the polynomial is the order of convergence of the algorithm, and (3) analyzing the efficiency of the composite HIF in order to determine those composites whose efficiencies are among the highest attainable. It is concluded that the use of derivatives tends to increase the order but decrease the efficiency, and that the composition of HIF's does not produce higher efficiencies than are attainable with single HIF's. Author (NSA)

N70-32758# Stanford Univ., Calif. Operations Research House.
SPARSE MATRIX TECHNIQUES IN TWO MATHEMATICAL PROGRAMMING CODES
George B. Dantzig, Roy P. Harvey (Standard Oil of Calif.), Robert D. Mc Knight (Standard Oil of Calif.), and Stanley S. Smith (Standard Oil of Calif.) Jan. 1969 19 p refs
(Contracts N00014-67-A-0112-0011; N00014-67-A-0112-0016; AT(04-3)-326; DAHC04-67-C-0028; Grant NSF GP-6431)
(AD-702047; TR-69-1) Avail: CFSTI CSCL 12/2

The authors empirically compared ten pivot selection rules for representing the inverse of a sparse basis in triangularized product form. On examples drawn from actual applications, one of the rules yield inverses that were only slightly less sparse than the original basis. The rule was used in the M5 mathematical programming system and has resulted in substantial reduction in running time. TAB

N70-32767 National Lending Library for Science and Technology, Boston Spa (England).
LARGE DEFLECTIONS AND STABILITY OF A DOUBLE CURVATIVE SLANTING SHELL WITH RIGIDLY FIXED EDGES
A. A. Nazarov 16 Mar. 1970 6 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), no. 3, 1958 p 231–234
(NLL-TIL-T-5071-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A double curvature shell rectangular in plane is considered. A set of equations is derived to describe large deflections and stability of the shell, the plane of which is positioned so that its center appears at the origin of coordinates and its sides parallel to the axes are equal to a and b, respectively. After the boundary conditions of the shell are established, the problem is solved in the first approximation. R.B.

N70-32769# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Mathematics.
A SURVEY OF TOP CATEGORIES
Oswald Wyler Jun. 1970 57 p refs
(Grant NSF GP-8773)
(Rept-70-26) Avail: Issuing Activity

Fibered categories are discussed and defined and general results of their calculation are given. The discussion includes lifting functors and natural transformations, lifting universal morphisms, top subcategories and functors, epireflective subcategories, point separators, top categories of algebras, cotop subcategories, images and relations, and continuous relations. R.B.

N70-32792# Maryland Univ., College Park. Dept. of Mathematics.
COMMUTATOR GROUPS AND ALGEBRAS
L. Greenberg [1969] 7 p ref
(Grant NSF GP-5927)
Avail: Issuing Activity

Let G be a real Lie group, and let H and K be connected Lie subgroups with given Lie algebras. The group /H,K/ generated by given commutators is arc-wise connected. The Lie algebra of /H,K/ is proved to be the smallest algebra which contains the given Lie algebras and to be invariant under ad of the given Lie algebras. If H and K are complex groups, then /H,K/ is also complex. The theorem is proved for several different conditions. Author

N70-32798*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
NUMERICAL SOLUTIONS OF INHERENTLY UNSTABLE ORDINARY DIFFERENTIAL EQUATIONS
Robert M. Myers June 1970 39 p refs
(Contract NAS9-5384)
(NASA-CR-108537) Avail: CFSTI CSCL 12A

The problem of determining numerical solutions of a differential equation which is inherently unstable is considered. In particular, the asymptotic continuation problem, which is formulated in this report, is analyzed. The development of a definition of error and an error analysis proceed naturally for this problem. Three algorithms are presented and each is applied to a particular example. In each case the algorithms are shown to be vastly superior to a standard numerical integration. In addition, the algorithms are shown to provide reasonable estimates of accumulated errors. The most surprising theoretical result is that a single initial relative error remains uniformly bounded on an unbounded interval even though different solutions may exhibit different exponential rates of growth. Author

N70-32838# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Mathematics.
CAUCHY TRIPLES
Oswald Wyler Jun. 1970 42 p refs
(Grant NSF GP-8773)
(Rept-70-24) Avail: Issuing Activity

Theorems on Cauchy triples and categories of spaces are proved. The discussion leads to the proof of the following corollary: If the category of separated spaces in ENS sup s is colocally small, then separated regular complete spaces define a reflective subcategory of ENS sup s and an epireflective subcategory of the category of separated spaces. N.E.N.

N70-32839# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
ON THE CATEGORIES OF TOPOLOGICAL ALGEBRA
Oswald Wyler Apr. 1969 13 p refs
(Grant NSF GP-8773)
(Rept-69-20) Avail: Issuing Activity

A general construction of operational categories and operational fibered categories is presented. A category of topological algebras, or of limit algebras, or of uniform algebras is also obtained from a given category of topological spaces, or of limit spaces, or of uniform spaces. Complements and examples are included. N.E.N.

N70-32852*# Bellcomm, Inc., Washington, D.C.
DIFFERENTIAL EQUATIONS SOLUBLE IN FINITE TERMS OF ELEMENTARY FUNCTIONS
C. C. H. Tang 26 Mar. 1970 55 p refs
(Contract NASw-417)
(NASA-CR-110654; TM-70-1014-1) Avail: CFSTI CSCL 12A

It is shown that the solution of a second order ordinary linear differential equation is expressible in finite terms by means of elementary functions, provided the coefficients are related in certain specific ways. By employing a general solution, two coupled nonlinear differential equations of second order are obtained, and one is able to classify various specific relations between the coefficients via these equations. The differential equations thus obtained include those hypergeometric equations which, owing to specifically assigned values of constants in their coefficients, can be solved in terms of elementary functions. Author

N70-32860# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mathematics.
TWO NOTES ON REGULARITY IN GENERAL TOPOLOGY
Oswald Wyler May 1970 14 p refs
(Grant NSF GP-8773)
(Rept-70-22) Avail: Issuing Activity

It is shown that the topological separation axiom T sub 3 can be regarded as a continuity condition for the convergence of filters. The given condition is expressed in two distinct ways with respect to connections between various continuity conditions for relations. It is also shown that the regularity defined for convergence spaces by a partial converse of the inverse limit property is a continuity condition for filter convergence. A definition of continuity for relations is given. R.B.

N70-33068*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CALCULATION OF N-DIMENSIONAL PROBABILITY ELLIPSOIDS
E. R. Lancaster Jul. 1970 8 p ref Submitted for publication
(NASA-TM-X-63970; X-643-70-271) Avail: CFSTI CSCL 12A

The problem is to find a real number c such the probability is p that a normally distributed random variable x will lie in an ellipsoid defined x prime Ax = c, where A is the inverse of the covariance matrix of x. This problem arises, for example, in orbit determination when it is desired to know the dimensions of an ellipsoid centered about the nominal value of the state vector at a given time such that the probability is p that the state error vector will be in the ellipsoid. Author

N70-33313# Akademiya Nauk URSR, Kiev. Inst. for Theoretical Physics.
ANTICLASSICAL APPROXIMATION
V. A. Kolkunov and V. I. Rostokin 1969 19 p refs Presented at the Conf. on High Energy Phys. and Theory of Elementary Particles, Kiev
(ITF-69-80; Conf-691035-3) Avail: AEC Depository Libraries

The expansion of the S-matrix of the Schrodinger one-dimensional equation results in a series with diverging integrals at large parameter of quasiclassics (anticlassical approximation). The reason for the appearance of the latter is the transition of the matrix elements phases to infinity. To calculate the finite values of the matrix elements moduli squares a special technique was worked out on the basis of which a series of anticlassical expansion was obtained. The formula is applicable to strongly varied potentials and, in addition to transmission coefficient, gives also the position of the first bound level. Author (NSA)

N70-33317# RAND Corp., Santa Monica, Calif.
VALUES OF NON-ATOMIC GAMES. 3: VALUES AND DERIVATIVES
R. J. Aumann and L. S. Shapley Jun. 1970 45 p refs
(RM-6216) Avail: CFSTI

The value of an n-person game is a function that associates to each player a number that, intuitively speaking, represents an a priori opinion of what it is worth to him to play in the game. A non-atomic game is a special kind of infinite-person game, in which no individual player has significance; such games have recently attracted attention as models for mass phenomena in economics. The characteristic function of the game is extended to a space that includes not only the ordinary coalitions (measurable sets) of players, but also certain ideal coalitions—intuitively, sets to which a player can belong at any intensity between 0 and 1. The value of the game is then redefined in terms of the derivatives of this extended function, following the principle that a player's value is based upon his incremental worth to coalitions. Author

N70-33318# RAND Corp., Santa Monica, Calif.
VALUES ON NON-ATOMIC GAMES. 4: THE VALUE AND THE CORE
R. J. Aumann and L. S. Shapley Jun. 1970 20 p refs
(RM-6260) Avail: CFSTI

The value of an n-person game is a function that associates to each player a number that, intuitively speaking, represents an a priori opinion of what it is worth to him to play in the game. A non-atomic game is a special kind of infinite-person game, in which no individual player has significance; such games have recently attracted attention as models for mass phenomena in economics. The core of a game is the set of outcomes that, intuitively speaking, no coalition of players can improve upon. The core is a basic concept that has been studied widely by both game theorists and economists. Under suitable assumptions the core of a non-atomic game consists of a single outcome and that this outcome coincides with the value is proved. The assumptions [superadditivity and homogeneity of degree 1] are satisfied in many cases of interest, including a basic economic application. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-32002*# Texas A&M Univ., College Station.
A LITERATURE SURVEY OF CLEAR AIR TURBULENCE
Don R. Veazey Mar. 1970 110 p refs
(Grant NGR-44-001-081)
(NASA-CR-106211) Avail: CFSTI CSCL 04B

The subject matter concerned with turbulence in clear air is summarized. Principal subjects covered include observational techniques, properties of CAT, correlations between CAT and synoptic parameters, forecasting of CAT, theories of CAT, and the remote detection of CAT. A brief summary of the method of perturbations also is given. Author

N70-32020# Environmental Science Services Administration, Silver Spring, Md.
SNOWFALL, SNOWFALL FREQUENCIES, AND SNOW COVER DATA FOR NEW ENGLAND
R. E. Lautzenheiser Dec. 1969 19 p refs
(ESSA-TM-EDSTM-12) Avail: CFSTI

Seasonal total snowfall averages and extremes, frequencies of various snowfall intensities from 1 to 8 inches in a day, and snow cover data are presented in a series of 8 maps and 2 tables. Some notes on difficulties in obtaining good snowfall data are included. Nearly 100 stations were studied for snowfall frequency and snow cover data, using around 30 years of record per station if available. None with less than 10 years of record were used. Results show a several-fold increase in seasonal snowfall, in days with 1 inch or more of snowfall, and in maximum snow cover depths, from the southeastern coastal area to the north and to higher elevations. Frequencies of heavy snowfalls, of 8 inches or more in a day, however, are more uniform over New England, averaging mostly once or twice a year. The monthly distribution of 1 and 4 inch daily snowfalls are shown. Author

N70-32136# Air Force Cambridge Research Labs., Bedford, Mass.
BIBLIOGRAPHY OF AFCRL REPORTS ON METEOROLOGICAL EQUIPMENT
George Mc Lean and Marilyn Carchia Feb. 1970 38 p refs
(AD-704549; AFCRL-SR-94; AFCRL-70-0092) Avail: CFSTI CSCL 4/2

The bibliography presents a listing of papers and publications by personnel of the Aerospace Instrumentation Laboratory (AFCRL) involved in the design, development, and test of meteorological equipment. Also included are related Scientific and Final Reports published under contracts. The bibliography is divided into groups by type of report (that is, AFCRL Reports, Journal Articles, and Contract Reports). Subject and Author indexes at the rear of the report may be used to locate reports that are of interest to the user. AD numbers are listed where available. Author (TAB)

N70-32150# Weather Bureau, Silver Spring, Md. Systems Development Office.
A METHOD FOR PREDICTING SURFACE WINDS
Harry R. Glahn Mar. 1970 21 p refs Sponsored in part by FAA
(ESSA-TM-WBTM-TDL-29) Avail: CFSTI

A method is presented which can be used operationally in forecasting surface winds. Various regression models are discussed and applied to available data. Verification on independent data indicates that this method produces short range forecasts of wind of equal or greater accuracy than the official aviation terminal wind forecasts. Author

N70-32183# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
ELECTRICAL EFFECTS FOR A NUMERICAL CLOUD MODEL
M. H. Smith and H. D. Orville Jan. 1970 45 p refs
(Contract NOOO14-68-A-0160; Proj. Themis)
(AD-704903; Rept-70-2) Avail: CFSTI CSCL 4/2

The report discusses the various atmospheric electrical effects that will need to be considered in a numerical model of mountain-induced cumulus clouds. The principal dependent variables to add to the model are the large and small ion concentrations, the cloud

and precipitation charge distributions, and the electric potential. Secondary dependent variables are the charge per unit volume, the electric field, the conductivity, and the current density. Typical values of these variables are given for initial conditions and boundary values of the model. TAB

N70-32231# Nigerian Meteorological Service, Lagos.
WIND FLOW AND ASSOCIATED WEATHER IN THE LOWER TROPOSPHERE OVER WEST AFRICA
J. O. Aina Jul. 1969 25 p refs
(NMS/TN/30) Avail: CFSTI

Cyclonic vortices observed at levels up to 5,000 ft or above were found to be good evidences of organized convection in the month of July. Synoptic analysis of an occasion of widespread rain and thunder activity over most of West Africa north of 10 deg N is discussed. The vortices in this case were organized on a large scale within a greater depth and occur in association with waves at higher levels. With regard to the advection of severe weather, it was found best to associate with the vortex in its south-eastern sector a moving bad weather zone. Author

N70-32243# Armament Development and Test Center, Eglin AFB, Fla.
THE OBJECTIVE PREDICTION OF AIR MASS THUNDERSTORMS Final Report, Apr.–Sep. 1969
John T. Forsing Apr. 1970 23 p refs
(AD-704596; ADIC-TR-70-100) Avail: CFSTI CSCL 4/2

The method of objective prediction of air mass thunderstorms was developed by researching and testing available methods. Bailey's method was selected for a more detailed evaluation because of applicability to the problem and sustained superior dependability at other locations. Verification revealed two changes should be made before further use at Eglin AFB. The 850-millibar horizontal wind shear parameter unnecessarily required more information and the occurrence prediction was modified because of the unique air mass situation in this coastal region. This method, with these changes, was proven by the evaluation to reliably guide the operational forecaster in the prediction of air mass thunderstorms. Author (TAB)

N70-32252# Nigerian Meteorological Service, Lagos.
AGROMETEOROLOGICAL BULLETIN
Dec. 1969 12 p
Avail: CFSTI

Selected climatological data of agricultural importance collected by telegram is presented for December 1969. Observation of temperature is made from thermometers exposed in the Stevenson Screen 4 feet above the ground. The humidity is deduced from the readings of the dry and wet bulb thermometers. Rainfall for any day is the amount recorded between 10 a.m. on that day and 10 a.m. the following day. Evaporation is determined from the standard class A pan (47-1/2 ins. in diameter and 10 ins. deep) mounted on wooden bearers and also from Piche evaporimeter enclosed in the Stevenson screen. Wind run per day is read from a cup counter anemometer mounted 7 feet above the ground. The maximum gusts for the month is read from a Dine's pressure tube or cup generator anemometer. Radiation is measured by the Gunn Ballani radiation integrator. Duration of bright sunshine is measured by the Campbell-Stokes tropical sunshine recorder. Author

N70-32318# Weather Wing (1st), San Francisco, Calif. Environmental Services.
CLIMATOLOGY FOR THE WESTERN PACIFIC AREA
18 Mar. 1970 80 p Revised
(AD-704599; WW-105-8-Rev) Avail: CFSTI CSCL 4/2

The study is a revised publication dealing with the climate of the Western Pacific Area. For the purpose of this study, the Western Pacific Area is defined as Southeast Asia, Philippines, Taiwan, Okinawa, Japan, Korea, and the islands of Guam and Iwo Jima. Author (TAB)

N70-32326# Environmental Science Services Administration, Washington, D.C. Office of Federal Coordinator for Meteorological Services and Supporting Research.
FEDERAL PLAN FOR UPPER AIR OBSERVATIONS ABOVE RESEARCH 30 KILOMETERS
Jul. 1969 78 p refs
(OFCM-69-7) Avail: CFSTI

The plan to coordinate the Federal agencies in launching 2880 meteorological rockets in FY-69 and 3690 in FY-70 in the 30 to 100 km region is presented. The upper limit was so designated to distinguish those observations of meteorological significance (such as pressure, density, temperature, wind, and ozone) from those generally ascribed to aeronomy. The Federal needs and data requirements, operational and coordination concepts, supporting research requirements, and data handling from initial acquisition to archiving are discussed. Characteristics of, and procurement sources for, atmospheric sounding rocket systems and components are listed. Author

N70-32342*# National Meteorological Center, Suitland, Md. Upper Air Branch.
WEEKLY SYNOPTIC ANALYSES, 5-, 2-, AND 0.4-MILLIBAR SURFACES FOR 1967
1970 174 p refs
(NASA Order P-40346-G)
(NASA-CR-110682; ESSA-TR-WB-12) Avail: SOD $1.50 CSCL 04B

Data from meteorological rocketsonde and rawinsonde observations were employed to analyze a series of high altitude synoptic charts. Methods employed for processing the various types of data and the analysis procedure utilized are described. Broad scale analyses of the 5, 2, and 0.4 mb surfaces, primarily covering North America and adjacent ocean areas, are presented at weekly intervals for 1967. A brief discussion of heat and temperature fields is also given. A major stratospheric warming in December and a less intense event in January are among the discussion items. Author

N70-32347# Nigerian Meteorological Service, Lagos.
WIND ROSES
Apr. 1969 37 p
(NMS/MN/21) Avail: CFSTI

An analysis was made of the three-hourly wind directions and wind speeds from fourteen of our synoptic stations, using wind vanes, dine pressure tube anemometers, or cup generator anemometers. The 3-hourly observations for each month were classified into different wind directions and speed ranges. The total observations within each speed range were found for each of the directions for the total number of years, on a monthly basis. From these results, tables were made showing by months the Percentage Wind Frequency Summaries based on 3-hourly wind records for each of the sixteen stations. From the tables Wind Roses were drawn up for each of the sixteen stations (12 roses for each station representing the months of the year). Wind Roses diagrams indicate percentage occurrence of calm frequency and frequency of the occurrence of wind at different speeds. E.M.C.

N70-32356# Air Force Cambridge Research Labs., Bedford, Mass.
EXTREME VALUES OF OZONE OBSERVED IN THE AFCRL OZONESONDE NETWORK
Thomas R. Borden, Jr. Jan. 1970 15 p refs
(AD-704547; AFCRL-ERP-312; AFCRL-70-0072) Avail: CFSTI CSCL 4/1

Values of maximum and 90 percentile ozone amounts observed during operation of the AFCRL ozonesonde network in North America are presented. The 90 percentile values are shown in cross section as a function of season, latitude, and altitude. The maximum values are represented by profiles of ozone versus altitude without regard to season or latitude. These results have application to the problems of ozone toxicity, harmful effects of ozone on vehicle components, and target detection by ultraviolet optical techniques. Author (TAB)

N70-32362# Weather Bureau, Silver Spring, Md. Systems Development Office.
SINGLE STATION PREDICTION OF CEILING AND VISIBILITY Interim Report
Roger A. Allen Apr. 1970 56 p refs
(Contract FA-67-WAI-131)
(FAA-RD-70-26) Avail: CFSTI

Equations were derived and tested for predicting ceiling and visibility at four terminals based upon weather observations at the local terminal alone. These equations were compared with similar equations based on data from a network of weather stations within approximately 200 miles of the terminal. The REEP screening technique was used to derive the equations, and forecasts on independent data were verified by means of the Brier score. It was found that the single station equations were only slightly less accurate than the equations based on networks. A test was made, also, of the effectiveness of stratifying the data by season and time of day prior to deriving the equations. No advantage was found in such stratification after considering the increased cost of deriving equations in that way. Author

N70-32474 National Lending Library for Science and Technology, Boston Spa (England).
ON THE QUESTION OF PULSATION OF VELOCITIES IN STRONG WINDS
S. Stanev et al 28 Nov. 1969 6 p ref Transl. into ENGLISH from Hidromet. Sluzh., Hidr.-Met. (Sofia), v. 17, no. 6, 1968 p 59–63
(NLL-M-7972-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Observations were taken every 2 seconds to study fluctuations in wind speed and their relationship to the mean speed. A general increase in wind fluctuations with increase in mean speed was found. The mean number of peaks per unit time varied considerably, and a mean value of 1 peak in about every 40 seconds was determined. The mean duration was 18 to 20 seconds, and 87% of the peaks were within 5 m/sec of the mean wind speed. It was also noted that data from two stations in sites with great physico-geographical differences were practically the same. N.E.N.

N70-32504# Nigerian Meteorological Service, Lagos. Ministry of Agriculture and Natural Resources.
AGROMETEOROLOGICAL BULLETIN NOVEMBER 1969
Nov. 1969 14 p
Avail: CFSTI

This bulletin contains selected climatological data of agricultural importance collected by telegram and is published monthly during the month following that of observation. The data therein are not fully checked and should therefore be regarded as provisional. Final checked data are available usually some months after the month of observation. Author

N70-32509 National Lending Library for Science and Technology, Boston Spa, (England).
THE INTERTROPICAL CONVERGENCE ZONE IN THE EASTERN PART OF THE PACIFIC ACCORDING TO OBSERVATIONS FROM METEOROLOGICAL EARTH SATELLITES
I. A. Alekseeva 28 Nov. 1969 12 p refs In ENGLISH and RUSSIAN Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR. Gidromet. (Leningrad), no. 36, 1968 p 27–35
(NLL-M-7963-(5828.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The purpose of the present paper is to describe the location of the intertropical convergence zone in the Eastern Pacific by means of the analysis drawn from television cloud pictures obtained in 1967. The satellite observations were obtained from three consecutive orbits, i.e., the data incorporated for each day were confined to a period of time not exceeding 4 hours. Individual television cloud pictures show the clouds associated with the ITCZ form a latitudinally elongated belt having a width of a few hundred kilometers. Author

N70-32510*# Environmental Science Service Services Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
LIGHTNING HAZARD TO ROCKETS DURING LAUNCH 2
Heinz W. Kasemir Jan. 1970 10 p refs Sponsored by NASA
(NASA-CR-110641; ESSA-TR-ERL-144-APCL-12) Avail: SOD $0.25; CFSTI CSCL 04B

Meteorological observation, including radar, is not sufficient for a lightning warning system at rocket launch areas - the key parameter of such a warning system has to be the electric field inside the cloud. If this has been measured, one has to know in addition the threshold value of the field for the different types of rockets that will cause: (1) corona discharge; or (2) lightning discharge by rocket penetration. Discussed is a program of investigation of the above mentioned research areas that deals with the determination of electric fields inside a cloud and with artificially triggered lightnings by test rockets. Author

N70-32536# Joint Publications Research Service, Washington, D.C.
PRELIMINARY RESULTS OF A STUDY OF ERRORS IN MEASURING LIQUID PRECIPITATION AT VOYEYKOVO
I. G. Gorbunova 19 Jun. 1970 22 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 175, 1965 p 132–142
(JPRS-50787) Avail: CFSTI

The results of measurements of liquid precipitation at Voyeykovo during 1962 and 1963 are given. The rain gauges used are briefly described and the accumulated data analyzed. The developed observational method makes it possible to differentiate errors characteristic of different instruments and qualitatively evaluate these errors. Author

N70-32542# Environmental Data Service, Silver Spring, Md.
IMPROVED ESTIMATES OF WINDS AT STANDARD HEIGHTS GENERATED FROM WINDS RECORDED AT STANDARD PRESSURE LEVELS
Harold L. Crutcher, Russell F. Lee, and Harold B. Harshbarger Mar. 1970 23 p refs
(ESSA-TM-EDSTM-15) Avail: CFSTI

Interim results of this study indicated that computers can extract data from the constant pressure levels to produce data for the constant height levels with three exceptions. These exceptions were at the friction layer, at the maximum wind layer and at the terminal point of the sounding. This last report indicates that for general purposes in electronic processing of constant pressure data, wind data need not be prepared for the constant height data for the terminal point of the sounding. The layer of maximum wind presents no problem. Only in the friction layer is there inadequate extraction of information. The last can only be resolved by detailed study of the original data. Author

N70-32561# Environmental Data Service, Silver Spring, Md.
CLIMATIC ATLAS OF THE UNITED STATES
Jun. 1968 164 p refs
Avail: SOD $4.25

Climatic maps are presented which provide a series of analyses showing the national distribution of mean, normal, and/or extreme values of temperature, precipitation, wind, barometric pressure, relative humidity, dewpoint, sunshine, sky cover, heating degree days, solar radiation, and evaporation. The map projection was standardized to allow accurate comparison and correlation of the various climatic elements and their patterns. Author

N70-32572 National Lending Library for Science and Technology, Boston Spa (England).
ON THE OBJECTIVE DETERMINATION OF THE TYPE OF CIRCULATION
A. A. Dmitriev 28 Nov. 1969 4 p refs Transl. into ENGLISH from Akad. Nauk, Mezd. Geofiz. Kom., Met. Res.(Moscow), Art. no. 16, 1968 p 347–348
(NLL-M-7957-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Equations and diagrams of the autocorrelation functions of long wave components are discussed, and the harmonics of the power spectrum for the whole 50 deg circle of North latitude is analyzed. The calculations made for the eastern and western hemispheres showed the same change of circulation, although the distribution of the harmonics in the two hemispheres were different. F.O.S.

N70-32618 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF THE EVOLUTION OF LONG WAVES IN FORECASTING AIR TEMPERATURE FOR A SEASON
B. R. Ur'eva 28 Nov. 1969 22 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent SSSR. Gidromet (Leningrad), no. 42, 1969 p 75–98
(NLL-M-7952-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

Developed is a long-range method of predicting temperatures over the Soviet Union by studying seasonal pressure waves over the Northern Hemisphere in relation to the circulation intensity. A system of indices is suggested for the intensity and succession of the long waves and a climatic classification is introduced to describe their characteristics objectively. Author

N70-32625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS CONCERNING THE TECHNIQUE OF SEEDING SUPERCOOLED STRATUS CLOUDS FOR THE PURPOSE OF SCATTERING THEM
S. K. Kudryavtseva et al 23 Mar. 1970 25 p refs Transl. into ENGLISH from Tr. Ukrainskiy Nauchno-Issled. Gidrometeorologicheskiy Inst., Vopr. Aktivnykh Vozdeystviy na Oblaka i Tumany (Kiev), no. 74, 1968 p 18–31
(AD-705146; FTD-MT-24-50-70) Avail: CFSTI CSCL 4/2

A report on cloud seeding and dispersion of stratus clouds is presented. To update methods of inducing rain and dispersing clouds and fog, it is necessary to determine optimum intervals between the seeding lines. An experimental study was carried out by the Ukrainian Hydrometeorological Research Institute for this purpose in the following manner: after sounding the cloud layer and establishing its parameters, initial seeding was made to find the maximum width of crystallization zone. Then the seeding was repeated along five or six lines normal to the wind direction at the cloud top level. Experiments showed that for complete dispersal of clouds the stage of cloud development is an important factor in determining the interval between the seeding lines. The experiments also indicated that larger dosages of seeding substances produce complete dispersion of clouds in the growing phase. Author (TAB)

N70-32642# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADAR CHARACTERISTICS OF PRECIPITATION OF DIFFERENT NATURE, SPECTRA, INTENSITY AND TEMPERATURES IN THE CENTIMETER AND MILLIMETER RANGES OF RADIO WAVES
N. P. Krasyuk et al 29 Oct. 1969 49 p refs Transl. into ENGLISH from Tr. Vysokogornyi Geofiz. Inst., Nalchik (USSR), no. 11, 1968 p 147–186
(AD-700401; FTD-MT-24-246-69) Avail: CFSTI CSCL 4/2

The specific effective area of retrograde scattering and attenuation factors of radio waves in the centimeter and millimeter range, by rainfall at various temperatures and intensities were calculated. This quantitative data on the attenuating and reflecting effect of rain is needed to estimate the effect of rain on the operation of electronic equipment in the centimeter and millimeter range. TAB

N70-32643# Naval Postgraduate School, Monterey, Calif.
RAWINSONDE ERRORS AND THEIR APPLICATION TO A MESOSCALE STUDY
Bruce Alan Clark (M.S. Thesis) Oct. 1969 79 p refs
(AD-704084) Avail: CFSTI CSCL 4/2

Several studies of rawinsonde component errors in actual flight tests are discussed. RMS relative errors between radiosondes are assumed for measured parameters. These errors are then used to derive RMS relative errors for other parameters such as wind speed and direction, height, virtual temperature, and mixing ratio. Expected RMS errors in measured and derived parameters are discussed in relation to the data obtained from the Oklahoma National Severe Storms Laboratory upper-air mesonetwork. It is found that many analyses and computations which are useful in synoptic-scale meteorology are not practical on the mesoscale. Wind data, when processed by computer, yield the most valid results. Author (TAB)

N70-32665*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
UPPER ATMOSPHERE DYNAMICS
Manfred P. Friedman 28 May 1970 59 p refs
(Grant NGR-09-015-002)
(NASA-CR-110721; SAO-Special-Rept-316) Avail: CFSTI CSCL 04A

Three-dimensional global models of the upper atmosphere (120 to 800 km) are constructed by solving the conservation equations of mass, momentum, and energy. Variation of conditions at the lower boundary, 120 km, affects the atmosphere only to about 200-km altitude. Differing results obtained by in situ satellite or rocket measurements in the 120- to 200-km range can therefore be explained as resulting from atmospheric behavior below 120 km. A study of possible wind fields is presented and diurnally varying winds with no steady east-to-west flow are discussed. Viscous forces at the higher altitudes match the pressure gradient forces and give rise to small wind magnitudes above 300 km. Maximum wind speeds are found to occur near 140 km, where viscous effects are not too great. Author

N70-32801# Environmental Science Services Administration, Boulder, Colo. Research Labs.
PLOTTER SUBROUTINE FOR METEOROLOGICAL STRAIGHT LINE FLIGHT DATA (SLENDER)
Heinz H. Grote Dec. 1969 40 p refs
(ESSA-TR-ERL-140-APCL-10) Avail: SOD $0.25

A subroutine SLENDER that works in connection with the plotting subroutine CRTPLT to provide a two-dimensional plot of a relatively straight flight path and four analog traces of selected meteorological parameters lined up with the flight path is described. Author

N70-32938*# Scientific Translation Service, Santa Barbara, Calif.
THE STRUCTURE OF THE TEMPERATURE FIELD IN A TURBULENT STREAM [STRUKTURA TEMPERATURNOGO POLYA V TURBULENTNOM POTOKE]
A. M. Obukhov Washington NASA Jul. 1970 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geograficheskaya i Geograficheskay (Moscow), v. 13, no. 1, 1949 p 58–59
(Contract NASw-2035)
(NASA-TT-F-13125) Avail: CFSTI CSCL 04B

The square of the temperature difference at two stream points is used to characterize the structure of a temperature field. The dependence of this quantity on the distance between the observation points is theoretically determined. The order of magnitude of the field characteristic of temperature pulsations in the atmosphere is determined. Author

N70-32974*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
THE ACOUSTIC WIND MEASUREMENT Final Report
D. L. Jones, G. M. Kakli, and G. R. Carignan Jun. 1969 58 p refs
(Contract NAS8-20357; ORA Proj. 07871)
(NASA-CR-102791; Rept-078-3-F) Avail: CFSTI CSCL 04B

A technique for measuring acoustic wind utilizing the exhaust noise of large booster rockets is described, and initial profiles are given. From the temperature profiles, measured independently, and the known vehicle trajectory, a correspondence is established between the sound arrival times and the location of the sound source, and the average horizontal winds between adjacent noise events is calculated. The data are obtained by nine microphones in a cross-shaped array, about 1200 meters along each axis, on the southeast point of Cape Kennedy. The circuitry, and data computation and reduction are described, and a method for far-field acoustic wind measurement is discussed. It is concluded that the system is now fully operational, essentially automatic, and capable of acquiring data on all large rocket launches. It is also felt that the addition of far-field sites would eliminate the requirement for separate determination of sound speed profiles and that the use of more sensitive microphones with self-contained electronics would make the system portable. N.E.N.

N70-33017# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DETAILED TIME-HISTORIES OF CONCENTRATIONS RESULTING FROM PUFF AND SHORT-PERIOD RELEASES OF AN INERT RADIOACTIVE GAS: A VOLUME OF ATMOSPHERIC DIFFUSION DATA
P. W. Nickola, J. V. Ramsdell, Jr., and J. D. Ludwick Feb. 1970 187 p refs
(Contract AT(45-1)-1830)
(BNWL-1272) Avail: CFSTI

A volume of atmospheric diffusion data of exceptional detail is presented. The concentration measurements were obtained from the release of the radioactive gas krypton-85 as an atmospheric tracer. Measurements were made simultaneously on a real-time basis at 64 field locations. The sampling array, arranged on sampling arcs at distances of 200 and 800 m from the tracer release point, consisted of 40 Geiger-Muller tubes at elevations of 1.5 m above the surface, with 24 more tubes located on six towers. Tower sampling extended to heights of 21 m. Eight of these inert gaseous tracer releases were in the form of instantaneous bursts or puffs, while the remaining five releases took the form of plume releases of 10 to 20 min duration. Vertical wind and temperature profiles for the periods of tracer transport are given. A description of the field system and field techniques is also included. Author (NSA)

N70-33107# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSACTIONS OF THE MAIN GEOPHYSICAL OBSERVATORY, NO. 207
O. P. Petrenchuk et al 10 Mar. 1970 27 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 207, 1967 p 82–86, 98–103
(AD-704883; FTD-MT-24-17-70) Avail: CFSTI CSCL 4/2

Content: Chemical composition of cloud water for the different microstructure of the clouds; An experimental investigation of temperature conditions in a nuclei condensation counter. TAB

N70-33233# Israel Program for Scientific Translations, Ltd., Jerusalem.
AVIATION CLIMATOLOGY
G. Ya. Narovlyanskii 1970 215 p refs Transl. into ENGLISH of the book "Aviatsionnaya Klimatologiya" Leningrad, Gidrometeorologicheskoe, Izd., 1968 Prepared for ESSA and NSF
(TT-69-55100) Avail: CFSTI

An applied science dealing with the influence of climatic factors on aviation technology and aviation activity, and specifically intended to develop methods of providing aviation with climatological data is discussed. An attempt is made to systemize and generalize the investigations carried out both in our country and abroad in the field of aviation climatology. Special importance is attached to the description of a calculation technique for various aviation-climatic indices which characterize flying conditions and which are allowed for in the design and operation of airports. The principles of the preparation technique of aviation-climatic descriptions are given. A brief characterization of the aviation-climatic conditions on certain international air routes is presented. Author

N70-33282# National Center for Atmospheric Research, Boulder, Colo.
NIWOT RIDGE REMOTE METEOROLOGICAL DATA ACQUISITION STATION
Paul A. Eden Jun. 1970 83 p Sponsored by NSF
(NCAR-TN-50) Avail: Issuing Activity

Detailed descriptions are presented on the operations base at the NCAR Laboratory in Boulder, and the remote station at Niwot Ridge. These two stations perform four main functions: system command and control, data collection and analog translation, telemetry, and power supply provision. The operations base at the NCAR Laboratory initiates the remote command signals which control the Niwot Ridge instruments, and is the receiving station for telemetry of data collected at the remote site. The data-gathering instruments operate continuously, but data transmission to Boulder is a function of command to the Niwot Ridge telemetry system. The Niwot Ridge instruments make continuous readings of temperature, wind speed and direction, atmospheric electric field, positive and negative conductivity, and solar radiation. This information is translated into analog voltages which are carried by radio signal to the NCAR telemetry rack. The total power requirement at Niwot Ridge is 12 V at 2 A, which is supplied by a wind-driven generator and storage battery system. The telemetry rack requires power supplies of + or − 12 V at 100 mA, + 3.6 V at 3 A, and + 30 V at 1 A. M.G.J.

N70-33270# National Center for Atmospheric Research, Boulder, Colo.
OBSERVATIONS OF AEROSOLS OVER NORTHEASTERN COLORADO, 1968
G. M. Hidy, R. Bleck, I. H. Blifford, Jr., P. M. Brown, G. Langer et al Jun. 1970 73 p refs Sponsored by NSF
(NCAR-TN-49) Avail: Issuing Activity

To try to establish links between aerosol behavior and cloud formation, observations of condensation and ice nuclei as well as

meteorological parameters were made. The measurements indicated that the aerosol population at the ground and at 20,000 ft and above was somewhat variable from day to day, but that particle concentrations at 2,000 to 3,000 ft above the ground were relatively more constant in time and space over a 40 mi square area above the Pawnee Grasslands. In general, the aerosol concentrations in a size range above 0.15 microns radius were remarkably low (approximately 1/cu cm) at cloud base. Aitken nuclei as well as ice nuclei were quite variable, but fell within a range of concentrations more or less typical of rural, continental conditions. Aerosol samples appeared to consist mainly of materials of nonmaritime origin, with differences reflecting the passage of different air masses over the sampling region. During the period of these observations it was not possible to detect a direct, unique connection between the onset of cloud development and aerosol behavior, either at the ground or in the air. Author

N70-33272# Naval Oceanographic Office, Washington, D.C.
ESTIMATE OF THE ERROR IN MEASURING WIND VELOCITY BY AN ANEMOMETER MOUNTED ON A BUOY [K OTSENKE POGRESHNOSTI IZMERENIYA SKOROSTI VETRA ANEMOMETROM, USTRANOVLENNYM NA BUYE]
R. S. Bortkovskiy 1970 9 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 187, 1966 p 163–166
(AD-704873; NOO-Trans-366) Avail: CFSTI CSCL 4/2

The error resulting from vertical fluctuations of anemometer when measuring the mean velocity of wind is discussed and appraised. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-32024# Naval Electronic Lab. Center for Command Control and Communications, San Diego, Calif.
ACCURACY OF OMEGA NAVIGATION SYSTEM USING 1969 SKYWAVE CORRECTIONS Research and Development Report, Sep. – Nov. 1969
E. R. Swanson 31 Dec. 1969 13 p refs
(AD-704504; NELC-1675) Avail: CFSTI CSCL 17/7

Fix errors are computed by systematic sampling of recorded phase-difference data, including data acquired during disturbed conditions and periods of rapid phase change. Variation of accuracy with position is estimated. It is concluded that Omega using 1969 skywave corrections is accurate to a fix error of about 1 mile in North America. Author (TAB)

N70-32075# Avco Corp., Lowell, Mass. Applied Technology Div.
FERROFLUID PARTICLE GYPO Final Technical Report, 17 Feb. 1969 – 16 Feb. 1970
Gabor Miskolczy, Rudolph Little, and Robert Kaiser Feb. 1970 51 p refs
(Contract F33615-69-C-1460)
(AD-704894; AFFDL-TR-70-5) Avail: CFSTI CSCL 17/7

The concept of using a volume of a colloidal ferromagnetic liquid, rotating at high speed under the influence of an applied electromagnetic torque as a gyroscope is studied. Two different experimental arrangements are described. Electromagnetic torques are applied at a variable rate, from 50 to 50,000 cycles per second, to a 2 cc volume of ferromagnetic liquid. The ferromagnetic liquid used is a water base colloidal suspension of finely divided magnetite. The rotation of the liquid volume caused by viscous coupling to the particles is observed at a maximum rate of over 4 revolutions per second. The bulk fluid rotation rate is observed to pass through a maximum value as the rate of the applied field is increased, and it is demonstrated to depend on the square of the magnitude of the field. A prior theory, predicting fluid torque and rotation, taking into account the disorienting forces acting on the particles, is adapted for a multidisperse colloid and numerical computations are given for the fluids used in the experiments. The experimental observations follow the predicted trends. Author (TAB)

N70-32575# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIO NAVIGATION OF AIRCRAFT
V. A. Odintsov 23 Jan. 1970 542 p refs Transl. into ENGLISH of the book 'Radionavigatsiya Letatelnykh Apparatov' Moscow, Izd-Vo Mashinostroyeniye, 1968 p 1–408
(AD-704025; FTD-MT-24-251-69) Avail: CFSTI CSCL 17/7

The report outlines theoretical fundamentals of radio navigation and there are shown possibilities of application of radio navigational aids in flight on contemporary aircraft. There is given a general method of evaluating radio navigational aids. There are given solutions of problems of guiding an aircraft to a predetermined point of the field of working region and determination of navigational elements with the help of nonautonomous and autonomous radio navigational aids. Furthermore, there is examined the application of electronic navigation systems during air traffic control and during landing of aircraft. There are covered questions of space radio navigation and there is evaluated navigation possibilities of radio navigational systems based on artificial earth satellites. Author (TAB)

N70-32591# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF RELIABILITY OF A SYSTEM FOR AUTOMATIC COMPUTATION OF COORDINATES
V. A. Prokofev 20 Feb. 1970 15 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchn.-Issled. Inst. Morsk. Flota (Leningrad), no. 92, 1968 p 95–102
(AD-703550; FTD-HT-23-85-70) Avail: CFSTI CSCL 17/7

The system for the automatic computation of coordinates (SACC) is an important factor in the complex automation of ships. It is designed to relieve the navigator of arduous plotting and calculations and to enable him to determine the most probable coordinates of the ships position in minimum time and to assess their accuracy. In the designing of a system of this kind its accuracy and reliability are crucial and are interrelated as well. Hence, the investigation deals with establishing a mathematical relationship between the accuracy and reliability of SACC. Author (TAB)

N70-32653*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESCRIPTION AND PERFORMANCE OF THE SATURN LAUNCH VEHICLE'S NAVIGATION, GUIDANCE, AND CONTROL SYSTEM
Walter Haeussermann Jul. 1970 50 p refs
(NASA-TN-D-5869) Avail: CFSTI CSCL 17G

A review of the navigation, guidance, and control system of the Saturn launch vehicle includes the system analysis and design, signal flow diagrams, redundancy, and self-checking features used to obtain extreme reliability for crew safety. The iterative path adaptive guidance mode, featuring flight path optimization, is explained and presented in its computational form. Following the analytical considerations, the main guidance and control components are described. Results from recent launchings of Saturn V vehicles are presented to confirm the adequacy of the navigation, guidance, and control system and its overall performance even under extreme flight perturbations. Author

N70-32736*# Bellcomm, Inc., Washington, D.C.
USE OF MAGNETIC TORQUE FOR CMG MOMENTUM MANAGEMENT
W. Levidow 29 Dec. 1969 46 p
(Contract NASw-417)
(NASA-CR-109710; TM-69-1022-8) Avail: CFSTI CSCL 17G

Gravity gradient and aerodynamic torques acting on the AAP workshop are counteracted by the momentum exchange action of the control moment gyros (CMGs) used for attitude control. However, the momentum accumulation due to the bias components of these torques must be dumped before CMG saturation is reached. For a second AAP workshop, for which stellar astronomy is being considered, it would be preferable to dump this bias momentum with a scheme that does not require attitude maneuvers. Such a dump scheme is investigated, using an onboard magnetic dipole interacting with the earth's magnetic field. A magnetic moment control law is suggested and minimum weight designs presented for both air and iron core coils. Author

N70-32753*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
REPEATABILITY, ACCURACY, PORTABILITY, AND ERRORS OF THE PORTABLE ALIGNMENT GYROCOMPASS SYSTEM
John J. Mihm and Richard A. Murphy Washington Jul. 1970 36 p
(NASA-TN-D-5650; C-90) Avail: CFSTI CSCL 17G

The precision alignment gyrocompass (PAG) system, a prototype system, was thoroughly evaluated. Information describing potential error sources such as draft sensitivity, warm-up time, creep, seismic disturbances, and their circumvention was generated. System repeatability is discussed as it affects operating procedures. Two-position, four-position, and H-modulation gyrocompass techniques were studied, tested, and evaluated. At one location, the PAG absolute system accuracy was checked against a precision astronomically referenced azimuth in a very quiet and stable suburban environment. At the second location, in a noisy urban area, an optical azimuth reference was established using the PAG. Author

N70-32787# National Aviation Facilities Experimental Center, Atlantic City, N.J.
BEACON VIDEO DIGITIZER (BVD) STATIC TEST RESULTS Interim Report, Nov. 1968 – Sep. 1969
Martin H. Holtz Jul. 1970 103 p
(FAA-RD-70-32) Avail: Issuing Activity

Test methods and results for the test and evaluation of the Beacon Video Digitizer (BVD) are described. A test bed was established to record BVD target reply and target report outputs on a digital computer. Technical tests were conducted to determine the characteristics of the BVD standardizer, garble detection logic, and beam splitting logic, and establish the function of the code validation and target detection circuits. Additionally, tests were conducted to determine the capability of the storage tube defruiter to eliminate non-synchronous returns (fruit), and its effect on target reliability and BVD target code validation. The test and evaluation program established the base line standards of performance for the digitizer. Further, the BVD test bed was used in a computer analysis of several air traffic control radar beacon systems environments. It was concluded that the BVD should operate with a sliding window size of eight bits and a lead edge and trail edge threshold criteria of two hits and one hit, respectively. The storage tube defruiter was determined to be an effective means of eliminating fruit; however, it decreased the target reliability approximately 15 to 20 percent. Author

N70-32923*# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
AN EXPERIMENTAL AND ANALYTICAL STUDY OF VISUAL DETECTION IN A SPACECRAFT ENVIRONMENT, 1 JULY 1968 – 1 JULY 1969
Roger P. Heinisch, Clinton L. Jolliffee, and Roger N. Schmidt Washington NASA Jun. 1970 244 p refs
(Contract NAS2-5015)
(NASA-CR-1561) Avail: CFSTI CSCL 17G

The objective of this investigation was to predict the star magnitude which can be seen with the naked eye or a sextant telescope through a spacecraft window. The effects of geometry and window coating on that objective were studied. An apparatus was built, instrumented, and used for measuring the scattering luminance of typical spacecraft windows. Window illumination from the sun, moon, and earth were computed for typical orbit conditions. Star magnitude thresholds were predicted from the scattering data and window illuminations by applying the classical Tiffany visual threshold data. The star thresholds were computed for both unaided vision and a monocular telescope. The measurements indicate that window cleanliness is of paramount importance in reducing light scattering. When considering the light transport through the spacecraft windows, light reflected off the windows from inside the spacecraft cabin was found to dominate the scattered light caused by the externally incident flux. Author

N70-33168*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AT SEA EVALUATION OF THE AN/SRN-9 NAVIGATION SATELLITE SYSTEM ABOARD THE USNS VANGUARD
John J. Mc Kenna May 1970 27 p Submitted for publication
(NASA-TM-X-63959; X-802-70-217) Avail: CFSTI CSCL 17G

The AN/SRN-9 is a radio receiving system designed to receive and to decode transmissions from orbiting satellites that comprise the NAVY Navigation Satellite System (NNSS). This system is capable of providing accurate position fixes at frequent intervals (approximately every hour and a half) without regard to the ship's geographic position on the earth's surface or to environmental conditions. The accuracy of the AN/SRN-0, Navigation Satellite System is evaluated under at-sea environmental conditions. The data collected consists of GEOS B/C Band radar, and AN/SRN-9, SINS position, and CORAC position fixes. The LORAC position fixes were used for position reference, with which to compare the AN/SRN-9 position fixes. The accuracy of the ship's position determined by using LORAC is assumed to be + or – 0.01 nautical miles. All data for both LORAC and the AN/SRN-9 (APL Datum) were referenced to the Fisher ellipsoid. Author

N70-33181* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INFRARED SCANNER Patent
Warren Gillepsie Jr., Norman M. Hatcher, and Robert J. Guillotte inventors (to NASA) Issued 5 Jun. 1962 (filed 18 Nov. 1959) 7 p Cl. 250-83.3
(NASA-Case-XLA-00120; US-Patent-3,038,077; US-Patent-Appl-SN-853984) Avail: US Patent Office CSCL 14B

An infrared scanning system for determining the orientation of an aerial or space vehicle relative to earth is described. Orientation is achieved by alternately detecting the emitted infrared radiations in two mutually perpendicular planes. The detected radiations are converted to electrical signals which determine the magnitude and direction of misalignment and control the application of thrust to correct the misalignment. P.N.F.

N70-33261*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT OF GUIDANCE-MONITORING TECHNIQUES AND GUIDANCE-MONITORING EXPERIENCE DURING THE APOLLO 11 LUNAR DESCENT
Christopher C. Kraft, Jr., Charley B. Parker, Howard G. de Vezin, Jr., and Emil R. Schiesser Jan. 1970 32 p Presented at the AIAA 6th Annual Meeting and Tech. Display, Anaheim, Calif., 20-24 Oct. 1969

(NASA-TM-X-58038) Avail: CFSTI CSCL 17G

Techniques were developed or using ground tracking capabilities for inflight real-time monitoring of critical spacecraft maneuvers for the case when it becomes necessary to switch to a backup guidance system or to initiate an abort. The guidance monitoring systems and techniques which were developed for the lunar landing phase of the Apollo 11 mission are described. The powered flight processor used during the mission proved effective for monitoring powered flight at lunar distances and is recommended as the prime external source of trajectory information on future lunar landing missions. Author

N70-33279* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

THREE AXIS CONTROLLER Patent

Euclid C. Holleman, inventor (to NASA) Issued 3 Apr. 1962 (filed 10 May 1960) 7 p Cl. 244-83

(NASA-Case-XFR-00181; US-Patent-3,028,126; US-Patent-Appl-SN-28175) Avail: US Patent Office CSCL 17G

A device for controlling a vehicle in flight about three orthogonal axes, either within or outside the atmosphere, is described. The device consists of a unitary three-axis controller of three ring assembled to move one each in the planes of yaw, pitch, and roll. Proportional movement of the vehicle in planes corresponding to the planes of movement of respective rings is accomplished by making the signals from a potentiomenter to an actuator for the control elements proportional to the ring movements. A resistance to the movement of each ring away from its null position is provided to give the operator a 'sense' of the position of the flight vehicle with respect to the vehicle's zero orientation position in any plane. R.B.

N70-33324*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

GLOBAL NAVIGATION AND TRAFFIC CONTROL USING SATELLITES

Leo M. Keane, Daniel L. Brandel, Peter D. Engels, Richard M. Waetjen Washington Jul. 1970 27 p refs

(NASA-TR-R-342; C-118) Avail: CFSTI CSCL 22A

A system approach is described which can support position determination, surveillance, and communications equirements of a large number of users. Position information can be computed and displayed at a traffic control center, and be transmitted to the users, together with traffic and hazard advisories, weather reports, and other messages. The system would also enable the user to compute his position independently on board. Digital communications at a rate of approximately 600 pps would be employed, while voice and high data rate digital communications can be accommodated at the cost of increased satellite ERP. Author

N70-33388*# Rensselaer Polytechnic Inst., Troy, N.Y.

INSTRUMENTATION STUDY OF PRIMARY NAVIGATION SYSTEM FOR A MARS ROVING VEHICLE

Jeffrey V. Wilson May 1970 61 p refs

(Grant NGL-33-018-091)

(NASA-CR-110750; RPI-TR-MP-13) Avail: CFSTI CSCL 22A

The development of instrumentation for a navigation system on an unmanned Mars roving vehicle is discussed. The instruments are found to require several unique applications of existing sensors and in some instances the desired system requires sensors not presently in existence. Features of the desired system include a determination of an inertial frame with origin at the planet center, establishment of a reference platform on the vehicle without use of conventional gyroscopic stabilization, a computation scheme for enabling a satellite to provide the vehicle with location data for targets beyond the vehicle's horizon, a surface dead reckoning scheme for continuous tracking of vehicle position, and a proposed flow diagram to combine all of these systems to provide the best possible position information. Instrumentation considerations are shown to influence orbit selection, areas and time of exploration, and to some extent basic vehicle configuration. New instruments are proposed to fill the information gaps identified and a discussion of the overall accuracy of the final configuration is included. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-32005*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN CHANGES IN SNAP-8 FOR REDUCED REACTOR OPERATING TEMPERATURES

George M. Thur [1970] 5 p refs Proposed for presentation at the 5th Intersocety Energy Conversion Engineering Conf., AIAA, Las Vegas, Nev., 21-24 Sep. 1970

(NASA-TM-X-52840; E-5767) Avail: CFSTI CSCL 18N

The SNAP-8 mercury Rankine system is a nuclear-electric power conversion system designed to explore the principles and technologies required for electric power production in space using liquid metals as working fluids. The current system is designed to produce a net electrical output of 35 kWe. A number of system changes are presently being considered as a result of endurance testing of the two most recent zirconium hydride (ZrH) reactors. The design changes and the resulting performance are discussed. Author

N70-32458 European Organization for Nuclear Research, Geneva (Switzerland). Lab. Dept.

DESIGN STUDIES FOR A LARGE PROTON SYNCHROTRON AND ITS LABORATORY

J. B. Adams and E. J. N. Wilson 26 Feb. 1970 59 p refs

(CERN-70-6) Copyright. Avail: Issuing Activity

Basic designs for a large proton synchrotron for use in the proposed new CERN Laboratory were studied. Three different types of accelerators were designed. These are the fixed energy, missing power, and missing magnet machines. The financial and technical requirements are discussed, and charts summarizing the planning data are included. F.O.S.

N70-32502# Defense Documentation Center, Alexandria, Va.

CLADDING, VOLUME 1 A DDC Bibliography, Aug. 1958—Feb. 1969

Mar. 1970 65 p refs

(AD-703450; DDC-TAS-70-12-1) Avail: CFSTI CSCL 13/8

Documents contained in the volume pertain to methods of cladding, cladding alloys, reactor fuel cladding, and applications thereof. Computer-generated indexes of Corporate Author-Monitoring Agency, Subject, and Contract are provided. Author (TAB)

N70-32582# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.

CONTRIBUTION TO THE URANIUM CARBON NITROGEN SYSTEM [BEITRAG ZUM URAN-KOHLENSTOFF-STICKSTOFF-SYSTEM]

Masahiro Katsura (Ph.D. Thesis—Tech. Hochschule, Aachen) May 1969 107 p refs In GERMAN

(Jul-594-RW; D-82) Avail: CFSTI

Theoretical and experimental work centered on the evaluation of uranium monocarbide and uranium monoitride mixed crystals for use as nuclear fuel elements. Known thermodynamic data of the

pure crystal components are analyzed and transferred to the U-C-N system for further correlation with experimental results. Emphasis is placed on the temprature region above or close to 1800 degree C when the mixed crystals are at equilibrium with UC2, respectively, liquid uranium. The relationship between temperature, nitrogen pressure, and structure of the mixed crystals is evaluated and the nitrogen solubility in the UC2 phase is determined. Arc melting studies on U-C compounds in nitrogen atmosphere establish that a second phase, existing besides the U(C,N), changes with increased carbon content from liquid uranium to UC2. It is shown that at a temperature regime between 2000 and 2150 degree C and at nitrogen pressure from 20 to 760 Torr UC2 always exists besides UC(1-x)N(x). Transl. by G.G.

N70-32598*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

UNAMIT: A ONE-DIMENSIONAL 4 pi SPHERICAL MULTILAYER REACTOR-SHIELD-WEIGHT OPTIMIZATION CODE

Eugene S. Troubetzkoy (Columbia Univ., New York) and Millard L. Wohl Washington Jul. 1970 21 p
(NASA-TM-X-2048; E-5619) Avail: CFSTI CSCL 18F

The computer code UNAMIT is described. The code generates 4 pi multilayer spherical reactor shields of minimum weight subject to a fixed shield surface dose rate constraint. The code uses an exponential attentuation - secondary-production analytic model. Methods are presented for determining required input parameters for attenuation of primary neutrons, primary gamma rays, and secondary gamma rays, and for production of secondary gamma rays. Discussion of the pertinent theory and operation of the code is presented in addition to listings of the code in Fortran IV and Fortran 63. Full input instructions and a sample problem output listing are presented. Author

N70-32599# Kerforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorbauelemente.

EXPERIMENTAL DETERMINATION OF CONVECTIVE HEAT TRANSFER ON CYLINDRICAL AND HELICOIDAL ABSORPTION RODS FOR THE THTR PROTOTYPE MWe [EXPERIMENTALLE BESTIMMUNG DER KONVEKTIVEN WAERMEUEBERTRAGUNG AN ZYLINDRISCHEN UND SCHRAUBENFOERMIGEN ABSORBERSTAEBEN FUER DEN THTR PROTYP 300 MWE]

Karl Heinz Presser Apr. 1969 19 p refs In GERMAN
(Jul-585-RB) Avail: CFSTI

Sherwood numbers were determined for heliocoidal and cylindrical absorption rod models in a spheroid bed by naphthaline/air system measurements. Analogy between mass- and heat transfer was used to calculate the Nusselt numbers. Results show that the median convective Nusselt numbers for helicoidal and cylindrical absorption rods are the same; they are about 17 percent lower than Nusselt numbers for spheres in similar spheroid bed measurements by Denton. The median convective Nusselt numbers for the core wall were about 20 percent lower than Denton values. Transl. by G.G.

N70-32629# Naval Postgraduate School, Monterey, Calif.

SEARCH FOR SHORT LIVED ISOTOPES IN VOLATILE REACTOR FUEL PRODUCTS

Ward Duane Fagan (M.S. Thesis) Jun. 1969 40 p refs
(AD-704085) Avail: CFSTI CSCL 18/2

The volatile radioactive nuclides produced by thermal neutron fissioning of uranium oxide-polyethylene fuel of the AGN-201 Reactor were collected in an evacuated aluminum cylinder. The following constituent isotopes, identified by gamma ray spectrometry, present in 20 minute old gas are: Te131, Xe131m, Xe133m, Xe133, Xe135m, Xe137, Xe138, Xe139, Se81, Se83, Kr85m, Kr85, Kr87, Kr88, and Kr89. Radioactive daughter products identified are Cs137, Cs148, Cs139, Rb88, Rb89, and I131. Other isotopes of iodine, tellurium, and bromine may be present. Spectra were taken with a NaI (Th) scintillation crystal. Author (TAB)

N70-32632 National Lending Library for Science and Technology, Boston Spa (England).

MAIN PROBLEMS CAUSING A REDUCTION IN THE AVAILABILITY FACTOR

J. Grangetas et al 24 Feb. 1970 33 p Transl. into ENGLISH from Elec. de France Report IAEA/SM-127/11 Presented at IAEA Conf. on the Performance of Power Reactors, Prague, 10-14 Nov. 1969
(NLL-WH-Trans-276-19091.9F); IAEA/SM-127/11) Avail: Natl. Lending Library, Boston Spa, Engl.: 3NLL photocopy coupons

Problems arising in the operation of Chinon 1, 2, and 3 reactors are described, and suggestions for their reduction are given. Four main problem areas are considered: (1) It is recommended that more simple heat exchangers be used to give higher reliability and more thorough inspection. Corrosion reduction measures and an adequate safety margin in the calculation of tube thicknesses are needed. (2) In the blower circuits, simplified auxiliary circuits should have a simpler and more robust mechanical system to reduce maintenance and adjustment on auxiliary circuits and valves. (3) Difficulties encountered with the refuelling equipment of the Chinon 2 were primarily of the prototype nature, and are no longer considered problems. (4) Incidents occuring with the turbogenerator units, of the developmental type, included stoppage of the lubrication pump, insulation defect in the generator core, and broken high pressure rotor blades. N.E.N.

N70-32633# Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div.

FAST BREEDER REACTOR STATIC PHYSICS METHODS DEVELOPMENT AND ANALYSIS PROJECT. VOLUME 1: FARED, ONE-DIMENSIONAL FAST REACTOR PHYSICS DESIGN AND ANALYSIS CODE

D. H. Roy, J. M. Tilford, A. Z. Livolsi, P. N. Colpo, C. D. Carmichael et al Oct. 1969 224 p refs
(Contract AT(30-1)-3867)
(BAW-3867-9-Vol-1) Avail: CFSTI

The results of a project to formulate, code, and production test a one-dimensional criticality and depletion code for use in performing rapid and accurate fast breeder reactor physics studies are presented. The basic FARED package comprises two codes. RETAP prepares a microgroup library for use by the cross section averaging and depletion routines. FARED is a one-dimensional static physics design code with an internal cross section collapse program; criticality, depletion, and search routines; fuel management capability; and a variety of edits including an extensive perturbation edit. All input is free format. Volume 1 contains a description of and an operating manual for FARED and RETAP. Volume 2 contains a listing of both codes. Volume 3 contains a listing of the output of the sample test problem. Volume 4 contains the results of various production test and critical experiment studies which were used to test the code and library. NSA

N70-32634# Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div.

FAST BREEDER REACTOR STATIC PHYSICS METHODS DEVELOPMENT AND ANALYSIS PROJECT. VOLUME 2: LISTING OF FARED AND RETAP PROGRAMS

D. H. Roy, J. M. Tilford, A. Z. Livolsi, P. N. Colpo, C. D. Carmichael et al Jan. 1970 468 p
(Contract AT(30-1)-3867)
(BAW-3867-9-Vol-2) Avail: CFSTI

For abstract see N70-32633.

N70-32635# Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div.
FAST BREEDER REACTOR STATIC PHYSICS METHODS DEVELOPMENT AND ANALYSIS PROJECT. VOLUME 3: LISTING OF SAMPLE PROBLEM OUTPUT FROM RETAP AND FARED PROGRAMS
D. H. Roy, J. M. Tilford, A. Z Livolsi, P. N. Colpo, C. D. Carmichael et al Jan. 1970 380 p
(Contract AT(30-1)-3867)
(BAW-3867-9-Vol-3) Avail: CFSTI
For abstract see N70-32633. For Vol. 4, see N70-27860.

N70-32640# Hittman Associates, Inc., Columbia, Md.
APPENDICES TO ADDENDUM TO PM-3A HAZARDS ANALYSIS REPORT, TYPE 4 CORE
Feb. 1970 75 p refs
(Contract AT(30-1)-3775)
(HIT-3775-1-APP; HIT-340-APP) Avail: CFSTI
Appendices presented discuss the following topics: Fission Product Inventory; Analog Equations; Analog Constants and Initial Conditions; Fuel Pellet Temperature Distribution Model; Pressure Calcultions; Velocity Analysis; and Analysis of Nuclear Effects in Refueling Accident. NSA

N70-32657# Argonne National Lab., Ill.
STUDIES OF FAST REACTOR FUEL ELEMENT BEHAVIOR UNDER TRANSIENT HEATING TO FAILURE. 3: IN-PILE EXPERIMENTS ON IRRADIATED UO2 FUEL PINS IN THE ABSENCE OF COOLANT
R. R. Stewart, C. E. Dickerman, L. E. Robinson, and W. B. Doe Mar. 1969 30 p refs
(Contract W-31-109-eng-38)
(ANL-7552) Avail: CFSTI
Studies of the behavior of stainless steel-clad uranium oxide fast-reactor type fuel pins under accident-simulating temperature excursions are under way in the TREAT reactor. Experiments on five preirradiated gas-bonded UO2 pins are discussed. The pins were tested in TREAT inside transparent capsules to permit recording of events by high-speed color photography. Fast-response thermocouples provided cladding surface-temperature data. These pins had been previously irradiated to a maximum of 6 a/o nominal burnup, at an initial power density of 2.5 kW/cc, producing initial fuel centerline and surface temperatures of 2400 and 1215 C, respectively. One pin was heated to a temperature just below that of cladding failure due to melting. Experiments on two other pins produced maximum fuel temperatures equal to the oxide melting point and resulted in severe cladding failure. Two pins were heated to temperatures in the intermediate range between these two extremes. Author (NSA)

N70-32685# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festokoerper- und Neutronenphysik.
MEASUREMENT OF BETA CHAIN LENGTH FOR DETERMINING THE PRIMARY NUCLEAR CHARGE IN FISSION PRODUCTS FROM THERMAL FISSION OF URANIUM (235) [BESTIMMUNG DER PRIMAEREN KERNLADUNG VON SPALTPRODUKTEN AUS DER THERMISCHEN SPALTUNG VON URAN 235 DURCH MESSUNG DER beta-KETTENLANGE]
K. Sistemich Feb. 1969 116 p refs In GERMAN; ENGLISH summary
(JUL-574-FN) Avail: CFSTI
The median primary nuclear charge of fission products from thermal fission of uranium (235) was determined by measuring beta chain lengths of fission products. Fission product separation was performed by a gaseous mass separator and a plastic scintillating detector with four pi geometry was used to measure beta chains for light fission products of the masses 86 less than A less than 104, as well as for heavier fission products with masses 137 less than A less than 153. A linear dependence of the median primary nuclear charge on fission product mass was established. Also determined was a median value for the distribution width of the primary nuclear charge which forms secondary mass fission products. Transl. by G.G.

N70-32723# Gulf General Atomic, San Diego, Calif.
RADIOISOTOPE SPACE POWER GENERATOR Annual Summary Report, 1 Jul. 1967 – 30 Jun. 1968
J. E. Cruver, R. G. Shevlin, R. L. Leedy, E J. Steeger, and F. L. Unmack Dec. 1969 86 p refs
(Contract AT(29-2)-2564)
(GA-8928-Pt-2) Avail: CFSTI
A 25 to 32-watt (BOL) generator design (nominally called the 30-watt generator) has been developed using ISOTEC technology. 400 C PbTe elements in a lightweight panel configuration. The modular construction of the ISOTEC generator has such flexibility that major components (thermoelectric panels and structural members) can be used directly to assemble generators with rated outputs ranging from 20 to 100 watts. The application toward which the 30-watt generator design was directed was the NAVSAT (20-watt EOL) navigational satellite, where high reliability for five year life and output greater than 2-watts per lb were important. Development of test generators to verify design calculations began in July, 1967, and the first test generator (GCO1) had been completed and performance tested by the following June. GCO1 exceeded the predicted values of both output power and thermal efficiency by about 10%. Additional test generators are being built and tested in a continuing development program. Author (NSA)

N70-32738# Oak Ridge National Lab., Tenn.
GAS COOLED REACTOR PROGRAM Semiannual Progress Report, Period Ending 30 Sep. 1969
Ann W. Savolainen, ed. Apr. 1970 163 p refs
(Contract W-7405-eng-26)
(ORNL-4508) Avail: CFSTI
Information concerning the development of high temperature gas cooled reactors is presented. General topics discussed include: high temperature gas cooled reactor development; gas cooled fast reactor development; and prestressed concrete reactor pressure vessel research and development. NSA

N70-32742# Oak Ridge National Lab., Tenn.
EXPERIMENT DESCRIPTION AND HAZARDS EVALUATION FOR THE SERIES 1 ORNL OXIDE FUELS IRRADIATION IN EBR-2
A. R. Olsen Apr. 1970 78 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2635) Avail: CFSTI
The Series I fuel tests involve five encapsulated stainless-steel-clad fuel rods containing Sphere-Pac (U,Pu)O2 derived from the ORNL sol-gel process. The analysis results indicate that these experiments can be conducted at a nominal peak linear heat rate of 14.7 kW/ft to a burnup of 50,000 MWd/Mt of U + Pu. A memorandum covering the details of fabrication is in preparation, and the five rods are being irradiated in a Row 4 position in the reactor. Author (NSA)

N70-32747*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs Dept.
POTASSIUM TURBOALTERNATOR PRELIMINARY DESIGN STUDY. VOLUME 2: REFINEMENT OF SELECTED TURBOALTERNATOR LAYOUT, PHASE 2
E. Schnetzer, ed. Washington NASA Jun. 1970 378 p refs
(Contract NAS3-10933)
(NASA-CR-1587; GESP-297-Vol-2) Avail: CFSTI CSCL 18E

The preliminary design selected from the Phase I study of a potassium turboalternator for space has been established as part of a nuclear Rankine cycle space power system of 2 MW sub th reactor power. The rating is 660 KVA, 450 kw sub e, 480 V (L-N), 1600 Hz. Potassium is the 2-phase turbine working fluid. Liquid potassium is the lubricant and the coolant. The turbine is all refractory metal. Design life is 3 years with growth potential to 5 years. Performance and design feasibility have been established. Remaining problems are turbine erosion, long term creep behavior of turbine rotor materials, and the alternator bore seal. Author

N70-32751# Allgemeine Elektricitaets-Gesellschaft, Frankfurt am Main (West Germany).
STUDIES OF CYCLONES FOR STEAM SEPARATION IN BOILING WATER REACTORS Quarterly Report, 1 Jul. – 30 Sep. 1969
20 Nov. 1969 8 p
(Contract EURATOM-083-66-1-TEED)
(EURAEC-2132; EUR-4022; AEG-E-323-1459; QR-12) Avail: CFSTI

Steam tests are considered to confirm the statements, which had been made as result of optimalization tests of steam separator cyclones in a air/water test facility. The test program is described. In air/water tests the steam outlet and the separation pipe were varied. In the considered steam experiments not only a reference cyclone but also cyclones with a reduced steam outlet and cyclones with a decreased separation pipe will be tested. The cyclone with the reduced separation pipe has a proportionally decreased steam outlet. It is intended to add three different water outlets for each of the reference cyclone and to the two varied cyclones. This will provide nine different geometries to be tested. Author (NSA)

N70-32761# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REACTOR FUELS AND MATERIALS DEVELOPMENT PROGRAMS FOR FUELS AND MATERIALS BRANCH OF USAEC DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY Quarterly Progress Report, Oct. – Dec. 1969
W. F. Sheely, ed. Feb. 1970 287 p refs
(Contract AT(45-1)-1830)
(BNWL-1279) Avail: CFSTI

The development of nuclear reactor fuels and materials is discussed. Subjects presented are: (1) airborne test reactor water loop operation and maintenance, (2) nondestructive testing, (3) irradiation damage to reactor materials, (4) fast reactor ceramic fuels, (5) irradiation behavior of fast reactor fuel materials, (6) fast reactor dosimetry and damage analysis, (7) fast reactor absorber materials, and (8) nuclear graphite. Author (NSA)

N70-32763# Atomic Energy Commission Research Establishment, Riso (Denmark).
USE OF THE THERMOHYDRAULIC SUBCHANNEL PROGRAMME HAMBO ON THE TEST ELEMENTS FT 36a AND FT 36b. PART 1: THE LOCAL VOID DISTRIBUTION
Frank W. Cortzen Feb. 1969 81 p refs
(FRIGG-PM-39; FRIGG-Note-R-39; RISO-M-869) Avail: AEC Depository Libraries

The thermohydraulic subchannel program HAMBO has been used to calculate the local void in circular subchannels of the FRIGG-FT 36a and FT 36b-test elements, which simulate the Marviken heavy water 36-rod fuel elements. The mean behavior of the void distribution for both elements are for high massflows simulated, within 3% by a scaling of the parameter, K, in the Bankoff-Jones void-correlation. This scaling is mass-flow-dependent for low mass flows. The distribution of void between the subchannels is regulated by the common mixing scaling parameter, Fm, which refers to the nominal mixing model in HAMBO. Author (NSA)

N70-32764# Atomic Energy Commission Research Establishment, Riso (Denmark).
FT-36b: RESULTS OF VOID MEASUREMENTS
J. A. Skaug, R. Eklund, and O. Nylund 5 Sep. 1968 48 p refs
(FRIGG-PM-15) Avail: AEC Depository Libraries

The experimental results of void measurements at 30, 50, 70 and 87 bars on the Marviken test element FT-36b are given. Complete tables of radial and axial void are included. A relatively detailed procedure is given and a section on possible errors is included. Most of the data have been plotted and curves are included for comparing different conditions. Some of these curves are based on a weak statistical basis and should be weighted accordingly. Compared to the results of the previous test section FT-36a, there are noticeable differences in the slip conditions which are not readily accounted for. Author (NSA)

N70-32765# Atomic Energy Commission Research Establishment, Riso (Denmark).
MTR-TYPE FUEL ELEMENT MODEL EXPERIMENTS AT REACTOR DR 3. 1: EXPERIMENTAL PROGRAMME AND FACILITY DESCRIPTION
Ingv. Rasmussen Aug. 1969 30 p refs
(RISO-M-976) Avail: AEC Depository Libraries

Investigations on the performance of subchannels of MTR-type fuel elements operating under high heat load conditions are presented. An outline is given of the experimental program, comprising studies on steady state and transient heat transfer, fission product release from fuel failures due to insufficient cooling, and fuel plate and in-core instrumentation performance. NSA

N70-32772# Allgemeine Elektricitaets-Gesellschaft, Frankfurt am Main (West Germany).
STUDIES OF CYCLONES FOR STEAM SEPARATION IN BOILING-WATER REACTORS Final Report, 1 Jan. 1968 – 30 Sep. 1968
17 Dec. 1968 87 p
(Contract EURATOM-083-66-1-TEED)
(EURAEC-2127; EUR-4020; AEG-E-323-1180) Avail: CFSTI

A study was performed on questions relating to the development of a steam separator based on gravity-type cyclones for a 160 MW(e) reactor, the tests being carried out in air/water as far as possible. This was done with a view to possible use in large nuclear power plants. Results are presented. In a 600 MW(e) project the steam separator consists of about 200 to 230 individual cyclones with an outer diameter of 170 mm, arranged radially in series in three rows. In order to pinpoint possibilities for increasing the capacity and reducing the pressure drop in the individual cyclones, air/water tests were carried out to determine the influence of certain important cyclone dimensions on the parameters carryunder, water ejection and total pressure drop. A total of nine different cyclones were measured, with different water outflow separations and separation tube and steam extraction tube diameters. Author (NSA)

N70-32806# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Feb. 1970
30 Mar. 1970 143 p refs
(Contract W-31-109-eng-38)
(ANL-7669) Avail: CFSTI

Highlights of project activities for February 1970 are summarized. LMFBR physics development, component development, and Na technology are reviewed. Operations and analysis of ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects, fuel fabrication, and operations are summarized. Reactor fuels and materials development, physics studies, engineering development, fuel cycle chemistry, and LMFBR safety studies are reported. NSA

N70-32822# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
THEDYBER: A PROGRAM FOR THE THERMODYNAMIC CALCUALTION OF SYSTEMS FOR STEAM-COOLED NUCLEAR REACTORS, BASIC THEORY AND PROGRAM DESCRIPTION
F. Erbacher et al [1969] 200 p Transl. into ENGLISH from Rept. KFK-824 Sponsored by US/EURATOM
(EURFNR-655; KFK-824; EUR-4165-d) Avail: CFSTI

The program which is described is used for calculating the efficiency of a steam-cooled fast breeder reactor and provides the power, flow, pressure, temperature and enthalpy data required for the design of the cooling circuit. Four different circuit systems are calculated with the program, depending whether the lower turbines are mounted in parallel or in series with the power turbine and whether reheating is used or not. The influence of a number of different parameters is studied by means of a comprehensive input list. The program is also flexible, so that it can be modified and extended relatively simply. Author (NSA)

N70-32848# Los Alamos Scientific Lab., N.Mex.
FABRICATION OF PEWEE NOZZLES
W. C. Turner Nov. 1969 27 p
(Contract W-7405-eng-36)
(LA-4324) Avail: CFSTI

The methods used in developing a process for brazing U-type cooling tubes to the nozzle shell of a Pewee reactor are described. The selection of an Au–Ni–Pd brazing alloy, the development of special fixturing, the use of a vacuum brazing atmosphere, and the evolution of a suitable method for applying the braze alloy are discussed. Two nozzles have been manufactured by applying these greatly improved brazing techniques. Author (NSA)

N70-32849# Oak Ridge National Lab., Tenn.
EFFECT OF ELECTRON HEATING ON OVERALL EFFICIENCY OF CONCEPTUAL MIRROR FUSION REACTORS
N. H. Lazar and G. R. Haste Apr. 1970 11 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2945) Avail: CFSTI

The principal limitation to fuel confinement in conceptual mirror reactors is the rapid scattering of the ions into the loss cone following cooling by the trapped electron distribution. The ion confinement time and nuclear reaction rate were estimated as a function of electron energy, assuming the space potential resulting from the hotter electrons can be controlled. It is shown that values of Q (nuclear power produced/power injected) nearly equal to 3 to 4 can be attained for the principal reacting region. These values would be sufficient to obtain significant fuel heating from charged reaction products so that the overall Q could approach 10. Author (NSA)

N70-32856# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
EVALUATION OF CELL PARAMETERS
K. Vlachovsky Oct. 1969 101 p refs
(ZJE-56) Avail: AEC Depository Libraries

An algorithm for a calculation of square, hexagonal or triangular lattice of a reactor with a cylindrical fuel element is presented. The fuel material is assumed in the shape of rod. The coolant can have the moderating capability. The mathematical model for the calculation of temperature of the neutron gas is presented. The method is made to be applicable for cells of different parameters. Author (NSA)

N70-32857# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTROL OF THE HOMOGENEITY OF SHIELDING [CONTROLE DE L'HOMOGENEITE DES BLINDAGES]
Jean Vertut and Lucien Papot 1969 8 p refs In FRENCH Presented at Intern. Symp. on Radiation Safety Probl. in the Design and Operation of "Hot" Facilities, Saclay, France, 13-17 Oct. 1969
(CEA-CONF-1427; CONF-691008-16; SM-125/53) Avail: AEC Depository Libraries

Control of cast concrete shielding homogeneity is evaluated as related to defects. The types of defects, specific defects, in transfer and transport containers, and the specific defects of shielded enclosures are discussed. The criteria for the acceptance of shield defects are given and critically analyzed. NSA

N70-32871# Argonne National Lab., Ill.
DEPARTMENT OF CHEMISTRY, PART 4 Semiannual Report, Jun.–Nov. 1968
Feb. 1970 47 p refs Transl. into ENGLISH from CEA Rept. CEA-N-1148 p 204–222, 248–271
(ANL-Trans-799) Avail: CFSTI

Developments are reported for studies on: aqueous processing of irradiated fuels based on natural uranium, which includes dissolution after boring of Sicral fuels with a graphite core, extraction of Ce(IV) by TBP, extraction of HF by 30% TBP, aqueous processing of Mosnal fuel; and effects of sulfates on fluorination of PuO2; natural and enriched uranium, which includes processing in pulsed columns and centrifuge extractor tests; Pu–Al fuels, which includes processing in diluted TBP and processing diagrams with 30% TBP on irradiated and nonirradiated fuels; experimentation and improvement of AT.1 process in Cyrano cell; and extraction of Pu by tridodecylamine diluted in an aromatic hydrocarbide, which includes TBP removal from a TBP–TLA–dodecane mixture and increasing the processing capacity of a Pu purification plant. NSA

N70-32873# Argonne National Lab., Ill.
DEPARTMENT OF CHEMISTRY, PART 5 Semiannual Report, No. 6, Jun.–Nov. 1968
Feb. 1970 36 p refs Transl. into ENGLISH from CEA Rept. CEA-N-1148 p 298–334
(ANL-Trans-800) Avail: CFSTI

Developments are reported for: processing of U–Zr and U–Al alloys; and processing of UO2–PuO2 fuels in stainless steel cans. NSA

N70-32896# Kernforschungszentrum, Karlsruhe (West Germany).
TRAPPING OF FISSION PRODUCT IODINE WITH SILVER IMPREGNATED MOLECULAR SIEVES
J. G. Wilhelm Oct. 1969 20 p refs Presented at Intern. Congr. on the Diffusion of Fission Products, Saclay, France, 4-6 Nov. 1969
(KFK-1065; CONF-691104-4) Avail: AEC Depository Libraries

The use of impregnated charcoal for the removal of fission product iodine is limited by relatively low desorption temperatures. In oxidizing gases, also ignition of the charcoal could occur. For trapping of fission product iodine in gases at high temperature and in the case of dangerous heat generation from fission product decay a nonflammable heat resistant adsorber material should be available for filtering devices. High removal efficiencies for methyl iodide and elementary iodine in air with relative humidities up to 100% were measured by filter beds made out of silver impregnated molecular sieve. Long time experiments were performed to test the removal efficiency of this material in dry air, steam-air mixtures, steam and helium; for air at temperatures up to 650 C. Author (NSA)

N70-32911# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
FRENCH EXPERIMENTS ON INSTRUMENTATION FOR CONTROL AND OPERATION OF REACTORS IN NUCLEAR POWER STATIONS [EXPERIENCE FRANCAISE SUR L'INSTRUMENTATION POUR LE CONTROLE ET LA

COMMANDE DES REACTEURS DANS LES CENTRALES NUCLEAIRES]
J. Furet 1969 79 p refs In FRENCH Presented at IAEA Panel Study on Instrumentation for Control of Nucl. Power Stations, Vienna, 17-21 Nov. 1969
(CEA-CONF-1455; CONF-691116-1) Avail: AEC Depository Libraries

Details relating to the instrumentation development and use in French fast and thermal power reactors are given. The instruments used in full power reactors are given. The instruments used in full power operation, control and operation with xenon instabilities are described; in-core instrumentation is discussed. Detector performance for low count-rate areas in the reactor is assessed. Time response, neutron sensitivity, and instrument lifetime are evaluated. Methods for data processing and data display are described; the use of on-line computer systems for data processing is discussed. NSA

N70-32916# Oak Ridge National Lab., Tenn.
ALGORITHM FOR CALCULATING REACTIVITY FROM NEUTRON FLUX USING AN ON-LINE DIGITAL COMPUTER
B. R. Lawrence (Australia AEC, New South Wales) and J. B. Bullock 8 Apr. 1970 19 p refs
(ORNL-TM-1473) Avail: CFSTI

An algorithm of calculating reactivity from phi and d phi/dt was derived for use on an on-line digital computer for the High Flux Isotope Reactor. A space-independent reactor kinetics model was used. The algorithm was tested on a general purpose digital computer using noise-free numerical flux traces. The results, which are applicable to a broad class of thermal reactors, show the effects of different integration step lengths and of neglecting d phi/dt on the calculated reactivity. Author (NSA)

N70-32917# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
METAL SWELLING EFFECTS ON FTR CORE COMPONENTS
R. J. Jackson, C. L. Wheeler, G. R. Waymire, and W. W. Little Mar. 1970 67 p refs
(Contract AT(45-1)-1830)
(BNWL-1286) Avail: CFSTI

An elastic analysis which considered neutron-induced metal swelling was performed on each typical component in the Fast Test Reactor core. The dilatation and duct bending resulting from the swelling and the swelling gradients are predicted for each component. Component interactions resulting from these dimensional changes are predicted, and duct-to-duct contact between supports during operation is proposed as a potential burnup limitation. Other potential burnup limitations from refueling considerations are discussed. Author (NSA)

N70-32918# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
STABILITY MARGIN FOR XENON OSCILLATIONS. ONE-DIMENSIONAL DIGITAL ANALYSIS
24 Feb. 1970 21 p refs
(BAW-10010-Pt-2) Avail: CFSTI

The analysis of Xe-induced oscillations in large power reactor cores requires the use of multidimensional computer programs. One-dimensional calculations in the axial direction show that axial power shaping rods are adequate for controlling or damping Xe oscillations. Computer programs have been developed to process the data from the one-dimensional calculations for use in subsequent multidimensional analysis. Author (NSA)

N70-32928# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
THE INFLUENCE OF THE DOWNSTREAM EFFECT ON THE RESULTS OF SODIUM CORROSION TESTS AND ITS USEFULNESS FOR REACTOR DESIGN [UEBERLEGUNGEN ZUM EINFLUSS DES 'DOWNSTREAM' EFFEKTS AUF DIE ERGEBNISSE VON NATRIUMKORROSIONSVERSUCHEN UND DEREN NUTZBARKETT FUER DIE REAKTORAUSLEGUNG]
H. U. Borgstedt, G. Frees, and G. Drechsler Sep. 1969 15 p refs
(KFK-1061) Avail: AEC Depository Libraries

The downstream effect in liquid sodium corrosion of stainless steels is normally described as an effect of the saturation of liquid sodium with corrosion products. Using the results of corrosion tests the increase in concentration of iron in sodium passing the hot parts of the systems was calculated. The results are compared with the saturation concentrations of iron in liquid sodium. There is no significant raise of the iron concentration in the high temperature sections of the loops. Therefore, the downstream effect cannot be due to the sodium saturation. The test results are free from any saturation influence and from systematic errors due to such an effect. Therefore, the measured corrosion rates can be used for reactor calculations. The downstream effect may be caused by inconstant conditions in the test sections of the corrosion loops. Author (NSA)

N70-32927# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
CARBIDE TYPE FUEL FOR FAST BREEDER REACTORS [KARBIDISCHE KERNBRENNSTOFFE FUER SCHNELLE BRUTREAKTOREN]
K. Kummerer and F. Thuemmler Oct. 1969 399 p refs In GERMAN; ENGLISH summary
(KFK-1111; EUR-4315-d) Avail: AEC Depository Libraries

In the first half-year of 1969 a seminar on carbide-type fuels for fast breeder reactors was held in the Nuclear Research Center Karlsruhe, to serve as an introduction to this large field of applied fuel science. The object of this seminar was to gain a most comprehensive view of the present knowledge and experience on these fuels. Seventeen contributions to the seminar are compiled in an elaborated and supplemented form. They are self-contained. The most essential results of the discussions are added to every single report. Beginning with the significance of these fuels for the application in fast breeders and the corresponding points of view in terms of reactor physics and economics, the series of subjects cover the important physical and chemical properties, the irradiation behavior, and the fabrication and reprocessing methods within the fuel cycle. A conclusive evaluation of the present status of knowledge is made. In this context, the most important goals of future practical development are also characterized. Author (NSA)

N70-32954# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report, Period Ending 31 Dec. 1969
Feb. 1970 79 p refs
(Contract AT(30-1)-4135)
(WARD-4135-5) Avail: CFSTI

Microcharacterization and mechanical property testing including biaxial tensile, stress rupture, and both uniaxial and biaxial creep were conducted on vacuum melted steels. Specimens of double vacuum melted 20% cold worked tubing were heat treated according to several schedules including one reported to give enhanced mechanical properties. These specimens have been tested and compared with the as-fabricated material. A limited series of biaxial tensile tests were conducted in which hold time prior to test was varied to determine the effect this variable had on the test data. Comprehensive structural characterization of two double vacuum melted tubing lots has been completed. Additional low cycle high strain fatigue tests were delayed pending proof testing of a new specimen design. An investigation of the effects of degree of cold work on weldability has also been completed. Author (NSA)

N70-32960# Sandia Corp., Albuquerque, N.Mex.
THE DEVELOPMENT OF THEORETICAL EQUATIONS TO DESCRIBE THE FLOW OF A RADIOACTIVE ION IN GROUND WATER
David B. Grove (U.S. Geol. Surv., Washington, D.C.) Oct. 1969 58 p refs
(SC-CR-68-3637) Avail: CFSTI

A mathematical modeling study of the flow of trace concentration of ions through a porous media is described. The theoretical work was performed as an aid in evaluating possible hazards resulting from the earth burial of a SNAP device containing radioactive fuel material. Author (NSA)

N70-32964# Hittman Associates, Inc., Columbia, Md.
SPHERICAL CAPSULE TECHNOLOGY PROGRAM. HEAT SOURCE TECHNICAL REPORT
Jan. 1969 310 p refs Sponsored by AEC
(HIT-370) Avail: CFSTI

Research and development efforts devoted to engineering optimization of a spherical radioisotope heat source for a low-temperature thermoelectric generator are described. Design and operation of a demonstration model of the heat source are also described. NSA

N70-32965# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
SHUT DOWN OF A FAST SODIUM-COOLED REACTOR BY MEANS OF ADDITION OF A NEUTRON ABSORBER TO THE COOLANT [ABSCHALTEN EINES SCHNELLEN NATRIUMGEKUEHLTEN REAKTORS MIT NEUTRONENABSORBIERENDEN ZUSAETZEN ZUM KUEHLMITTEL]
Stefan Dorner and Klaus Schroeter Aug. 1969 14 p refs In GERMAN
(KFK-1048; EUR-4312) Avail: AEC Depository Libraries

A theoretical analysis is performed of a Na-cooled fast reactor excursion with core deformation. To achieve a sudden shutdown in such an emergency, addition of Li to the Na coolant appears most suitable and technically feasible. Due to its high neutron cross section, Li-6 must be employed. For the Li – Na alloy the following properties are discussed. (1) rate of mixture, (2) corrosive behavior, and (3) separation of Na and Li. NSA

N70-32997# Gulf General Atomic, San Diego, Calif.
PUBLIC SERVICE COMPANY OF COLORADO 330-MW(e) HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report, Period Ending 31 Dec. 1969
30 Jan. 1970 179 p refs
(Contract AT(04-3)-633)
(GA-9875) Avail: CFSTI

Activities and progress are described for two areas of research and development. The first consists largely of component development and testing, nuclear analysis, and fuel development and testing. The second area is composed of fuel transfer machine, series steam turbine driven circulator, control rod drives, steam generator, and coated particles. Author

N70-33006# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MARK 1 PROTOTYPIC FTR FUEL ELEMENT SUBASSEMBLY SODIUM FLOW TEST
M. K. Millhollen, T. J. Bennett, and R. L. Myers Mar. 1970 77 p
(Contract AT(45-1)-1830)
(BNWL-1261) Avail: CFSTI

The subassembly was tested in flowing 1060 F sodium in the Core Components Test Loop (CCTL) at Argonne National Laboratory. The subassembly comprised 217, 0.250-in. diameter by 71-in. long fuel pins, assembled into a hexagonal array on a bottom grid arrangement and contained within a hexagonal flow duct. The flow duct shape changed from hexagonal to round above the fuel section of the pins. Individual pins were wire wrapped on a 12-in. pitch with 0.030-in. diameter wire, which provided constant pin spacing in the bundle. Cladding, wire wrap and flow duct were fabricated from Type 304 SS. The subassembly was under flow test in the CCTL for 5067 hr, 3687 of which were at full sodium flow (400 gal/min) and isothermal temperature (1060 F) conditions. Sodium chemistry was checked frequently to ensure that the oxygen content of the coolant did not exceed 10 ppM and that the carbon content did not exceed 20 ppM. When the subassembly was finally removed from the test loop, it was immersed in Dowanol-EB and then in alcohol to remove residual sodium. No significant surface corrosion was observed on the wire wrap, cladding or flow duct. Dimensions of the fuel pins did not change appreciably, but all wire wraps loosened, some as much as 0.006 inch. Author (NSA)

N70-33007# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
OXIDE FUEL ELEMENT DEVELOPMENT Quarterly Progress Report, Period Ending 31 Dec. 1969
Feb. 1970 109 p refs
(Contract AT(30-1)-4135)
(WARD-4135-4) Avail: CFSTI

Activities in a program involving parallel analytical and experimental studies on mixed oxide fuel pins are reported. Progress is reported on fuel performance analysis, improvement of analytical methods and fuel lifetime codes, encapsulated mixed oxide fuel pin irradiation tests, mixed oxide irradiation tests in grid-type subassemblies, pin grid-type fuel assembly design and development, development of LMFBR fuel assemblies, fabrication of EBR-2 subassemblies, pellet fabrication, fabrication of irradiation test fuel pins, and quality control. NSA

N70-33020# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
THE WEAR BEHAVIOR OF STEELS AND ALLOYS IN LIQUID SODIUM
E. Wild et al Apr. 1969 51 p refs Transl. into ENGLISH from Rept. KFK-973 Sponsored by US/EURATOM
(EURFNR-696) Avail: CFSTI

The wear behavior of pairs of materials for bearings and bushings for sodium-cooled reactors was examined for 36 different combinations of materials under the same operating conditions. The model geometry used consisted of three cylindrical samples which performed oscillating movements on a disk. The investigations were carried out in a test rig with a continuous sodium flow. The more favorable combinations of materials are to be tested in more detailed parameter studies, with special attention to the influence of temperature, stress, sliding velocity, and the oxide content of the sodium. Author (NSA)

N70-33021# Atomics International, Canoga Park, Calif.
S8DR ACTUATOR Final Report
L. E. Donelan 15 Mar. 1970 37 p refs
(Contract AT(04-3)-701)
(AI-AEC-12925) Avail: CFSTI

High-temperature, radiation-resistant, rotary actuators were developed for use in the control system of SNAP reactors. These actuators are electromagnetic, variable reluctance, stepping devices with integral, spring-loaded brakes. Five actuators were built, and four of these were tested successfully to the environmental and performance requirements of the SNAP 8 Development Reactor (S8DR) Program. These tests were concluded; the final results are presented. The five actuators were modifications of the originally designed units. These modifications were made as a result of design margin tests which were conducted at 1125 F (100 F above

maximum design temperature). The results of the design verification tests that were conducted on the modified actuator are included. The results of the tests indicate that the modified actuators meet all environmental and performance requirements for the S8DR Program. Author (NSA)

N70-33026# Oak Ridge National Lab., Tenn.
MAINTENANCE MANUAL FOR THE HFIR INSTRUMENTATION AND CONTROL SYSTEMS. PART 1: INTRODUCTION
P. Rubel 2 Mar. 1970 27 p
(ORNL-TM-1639-Pt-1) Avail: CFSTI

Because the normal high power density in the core of the High Flux Isotope Reactor approaches burnout conditions much more closely than other reactors, greater responsibility is placed on the instrument and control systems to avoid damage to the reactor. Three clearly defined instrument systems provide the necessary control and protection functions. These are: the wide-range counting channels, the regulating or servo channels, and the safety channels. Each of these systems is automatically keyed or adjusted for particular modes of reactor operation. In addition to the above systems, many of the process parameters (water flow, temperature, etc.) are monitored and regulated at predetermined setpoints by automated control instruments. The instrument and control systems are described. An index to other reports giving detailed maintenance information on individual systems is included. Author (NSA)

N70-33027# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CALCULATIONS OF BURNUP AND DAMAGE FOR FAST REACTOR FUELS
R. E. Dahl, Jr. Apr. 1970 24 p refs
(Contract AT(45-1)-1830)
(BNWL-1324) Avail: CFSTI

A method has been developed for relating burnup in fast reactor fuels to the damage sustained by the cladding. Traditionally, data on structural materials irradiation tests are reported in units of fluence while fuels irradiation data and design requirements are in terms of burnup. The relationship between these systems must be determined so that the properties of the cladding can be predicted accurately for LMFBR fuels. These analyses show that the cladding to burnup ratio depends in a complex manner upon the initial fuel composition, the neutron spectrum and the duration of the irradiation. Moreover, the conditions in an LMFBR cannot be duplicated in any test reactor. Therefore, analyses are required in both the application of test irradiation data to LMFBR fuel design and in the selection of irradiation facilities. Problems on the loss of pin power during extended irradiations and uncertainties in conventional burnup measurements are discussed. Author (NSA)

N70-33028# Oak Ridge National Lab., Tenn.
OAK RIDGE RESEARCH REACTOR Quarterly Report, Oct. - Dec. 1969
W. H. Tabor and S. S. Hurt, III 20 Mar. 1970 68 p Sponsored by AEC
(ORNL-TM-2955) Avail: CFSTI

Operations and maintenance requirements during October to December 1969 are described. Experiments and testing programs are reviewed. Author (NSA)

N70-33032# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
NUCLEAR FUEL AND MATERIALS (U, BE, ZR) FOR REACTOR
Yoshitsuga Mishima Feb. 1970 17 p Transl. into ENGLISH from Kogyo Reametaru (Tokyo), no. 39, Sep. 1968 p 19-22 In ENGLISH and JAPANESE
(LIB/TRANS-240) Avail: AEC Depository Libraries

In the power generation program made public in January 1968, it was announced that the Japanese nuclear power installation would be generating 6.93 million kW by the end of 1975. Uranium ore was secured as much as 58% of the necessary amount up to 1978. The supply of U for the Tokai power station and the reproduction of used fuel were guaranteed by Great Britain; and the private ownership of nuclear fuel, the enriching service of 161 tons of U, and the procurement of 365 kg of Pu for research and development were guaranteed by the U.S.A. In order to prepare for the start of operation of nuclear power plants, standards relating to the transporting vessel for nuclear fuel and the criteria for inspections were drawn up. The qualitative problems of domestically produced fuel for the light water reactors were almost solved. The prototype conversion reactor with 200,000 kW output was scheduled to reach criticality in 1974. The fast breeder reactor fuel were to be produced in Japan. A decline of ductility in a beryllium alloy sheath tube due to helium damage was analyzed. A 901 kg rectangular bar of Be was used for the reflector in the material testing reactor JMIR. Author (NSA)

N70-33033# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Heisse Chemie.
DESIGN OF AN ELECTROLYTIC CELL AND PLAN OF A TEST STAND FOR DIRECT REDUCTION OF Pu(IV) [ENTWURF EINER ELEKTROLYSEZELLE UND PLANUNG EINES VERSUCHSSTANDES ZUR DIREKTEN REDUKTION VON PLUTONIUM IV]
B. F. Roth and W. Roos Dec. 1969 23 p refs In GERMAN
(NP-18167) Avail: AEC Depository Libraries

The direct electrolytic reduction of plutonium in process streams in the 1B battery is an effective method for separation of uranium and plutonium. The greatest advantages of this method are observed at high plutonium concentrations such as occur in the reprocessing of fuel from fast breeder reactors. Author (NSA)

N70-33035# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
FISSPROD: A G-20 COMPUTER PROGRAM
F. E. Lane Nov. 1969 47 p
(AECL-3038) Avail: AEC Depository Libraries

FISSPROD is a computer program to calculate the concentrations and total neutron absorption of up to 200 fission product nuclides. The accumulation and decay of the fission products are described by a system of first order differential equations which is represented and solved in the program as a lower triangular matrix equation. FISSPROD is written in APEX-4, an ALGOL-like computer language developed at CRNL for the CDC G-20 computer. Author (NSA)

N70-33038# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
SEMIANALYTIC SOLUTION OF THE TIME-DEPENDENT AND PLACE-DEPENDENT NONLINEAR XENON PROBLEM
T. Auerbach, J. Mennig, and E. Gujer Oct. 1969 33 p refs In GERMAN
(EIR-164) Avail: AEC Depository Libraries

The space-dependent xenon problem of reactor theory leads to a series of non-linear partial differential equations, which cannot be solved exactly. All previous treatments of the problem represent approximations with linear differential equations. Presented is a relatively simple semianalytic method in which the space variable is divided into discreet steps. The corresponding differential equations with respect to time are developed and analytically integrated. NSA

N70-33039# Princeton Univ., N.J. Plasma Physics Lab.
TIME-DEPENDENT BEHAVIOR OF FUSION REACTORS
R. G. Mills Apr. 1970 43 p refs

(Contract AT(30-1)-1238)
(MATT-728) Avail: CFSTI

If a deuterium–tritium plasma with a temperature of about 10 keV or higher can be produced and confined under conditions such that the product of the ion density and the confinement time is of the order of 10 to the 14th to 10 to the 15th power sec/cu cm, it will be physically possible to produce a nuclear-fusion chain reaction. The power required for the ignition of a thermonuclear plasma may be an important consideration for the design and economy of a plant. This power may be excessive unless the confinement time decreases as the plasma density rises, preferably in inverse proportion. Computer codes have been written to follow, in time, the development of a high-temperature reactive plasma. A variety of results using these codes is present.
Author (NSA)

N70-33080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NEW APPROACH TO THE SMALL ACCELERATOR VACUUM SYSTEM
Robert Steinberg and Donald L. Alger Washington Jul. 1970 10 p refs
(NASA-TM-X-2052; E-5653) Avail: CFSTI CSCL 20G

The incorporation of a titanium bulk sublimator in combination with a getter ion pump in a small accelerator vacuum system is shown to provide major advantages in pumping performance, reduction of the tritium hazard, and improvement in system reliability. A mode of operation is suggested for the sublimator which can greatly increase sublimator lifetime. Typical operating data for the vacuum system of a 300 kilovolt accelerator equipped with a sublimator/ion pump combination are presented. A suggestion for the adaptation of a comparable vacuum system to a standard 150 kilovolt accelerator is made.
Author

N70-33083# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
SNAP-23A EMS-ELECTRICAL HEAT SOURCE FAILURE ANALYSIS REPORT
A. Hoppe Feb. 1970 244 p refs
(Contract AT(30-1)-3800)
(WANL-3800-24; WANL-TR-(SS)-1) Avail: CFSTI

SNAP-23A is the designation of a program to develop an advanced terrestrial radioisotope, thermoelectric power system capable of delivering 25 to 100 W(e) for 10 years. An electrically heated mockup system (EMS) was built and on thermal test when heater input power irregularities and a cover gas leak caused shutdown. A task force was organized to analyze the cause of failure, effect repairs, rebuild the unit, and resume thermal testing. The disassembly, analysis, testing, cause of failure, redesign, rebuilding procedures, and successful retesting of the system are described. The prime cause of operational difficulty was electrical shorting of input heater power through carbon-contaminated lava insulators in the heaters. A contributing problem was excessive oxidation of Ag-Cu braze alloys on ceramic-to-metal insulated electrical feedthrough seals. The seals were eliminated in the redesign, and the sources of carbon contamination (cleaning solvents and outgassing products) were eliminated by changes in reassembly procedures.
Author (NSA)

N70-33108# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik.
PYGMY: A ZERO-DIMENSIONAL BURN-UP PROGRAM FOR FAST REACTORS
L. Mayer Oct. 1969 28 p refs Supported in part by EURATOM
(KFK-1056; EUR-4313-E; EURFNR-739) Avail: AEC Depsoitory Libraries

PYGMY is a refined and extended version of the zero-dimensional burn-up code PYRE, which calculates the changes of reactivity, neutron spectrum, and isotopic concentrations with time, taking into account management operations and allowing for a very general isotopic scheme. The code is written in Fortran IV for the IBM 360. An input description and a sample case are presented.
Author (NSA)

N70-33109# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik.
TRANSPORTATION OF IRRADIATED FUEL ELEMENTS FROM FAST BREEDER REACTORS [TRANSPORT BESTRAHLTER BRENNELEMENTE AUS SNELLEN BRUTREAKTOREN]
G. Boehme, K. Gast, D. Gupta, A. Hagen, R. Kraemer et al Nov. 1969 184 p refs In GERMAN
(KFK-666) Avail: AEC Depository Libraries

A comparison of the activity and heating of irradiated fuel elements from fast breeder and light water reactors during transport, shows that an extensive study is necessary of the safety precautions, the engineering problems such as criticality safety, gamma and neutron shielding, cooling, and accident safety in order to design the optimum transport container for the fuel elements. Safety questions are considered, and then the selection of the coolant and construction materials is discussed. The effect of the fuel element and reactor design data in fast breeders is investigated. Engineering problems e.g., heat transfer, gamma shielding, neutron shielding, criticality, and accident results, are considered in detail. Transportation costs are discussed. Optimization of transportation is considered. Typical container designs are reported. The results of a literature search on the design of transport containers for fuel elements from fast breeder reactors are given.
NSA

N70-33126# Stanford Linear Accelerator Center, Calif.
DAMPING OF COHERENT BEAM OSCILLATIONS IN A STORAGE RING. 1: BETATRON EXCITATIONS [O DEMPFIROVANII KOGERENTNYKH KOLEBANII PUCHKA V NAKOPITELE]
Ya. S. Derbenev et al [1970] 38 p Transl. into ENGLISH from Russian Preprint no. 315
(SLAC-Trans-106) Avail: CFSTI

The dynamics of small coherent betatron excitations of a beam circulating in a chamber with a doubly connected waveguide and with both ends of the waveguide loaded with an impedance equal to the wave impedance are studied. It is shown that one-dimensional excitations of any multipolarity are damped, and expressions are obtained for the damping rates in the case of homogeneous and bunched beams. It is seen that the estimated damping time constant for dipole oscillations is in good agreement with the experimental fast-damping time for the VEPP-2. It is also shown that two-dimensional excitations (r,z) are unstable for certain ratios of transverse dimensions and betatron frequencies.
NSA

N70-33127# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS ON HIGH-TEMPERATURE FUELS TECHNOLOGY DURING NOVEMBER 1969–JANUARY 1970
Donald L. Keller and Walston Chubb Feb. 1970 79 p refs
(Contract W-7405-eng-92)
(BMI-1879) Avail: CFSTI

Columnar grains 25 to 50 microns wide and 100 to 1000 microns long were observed from the centerline to the cladding of a UO2 specimen which operated at a maximum surface temperature of 1555 C. This specimen released approximately 90 percent of its fission gas and swelled approximately 10 vol %. UO2 specimens operating at higher surface temperatures (1600 to 1900 C) showed similar columnar grain structures and similarly high gas releases, but the rate of swelling increased rapidly as the temperature increased. Columnar grains 20 to 40 microns wide and 40 to 80

microns long were observed from the centerline to the cladding of a UO2 specimen which operated at a maximum surface temperature of 1360 C. This specimen released approximately 75 percent of its fission gas and swelled approximately 5 vol %. The amounts of swelling observed correlate neither with gas pressures measured inside claddings nor with the thermal cycling history of the UO2 specimens, so it is concluded that the external swelling of these elements is caused by the growth of fission-gas bubbles within the UO2. Author (NSA)

N70-33136# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
REFRACTORY METAL FUEL ELEMENT RESEARCH Final Report
J. F. Collins Dec. 1969 15 p refs
(Contract AT(40-1)-2847)
(GEMP-741) Avail: CFSTI

Isothermal stability testing of refractory metal clad W-UO2 cermet fuel element specimens for times in excess of 10,000 hours was completed. Optimum thermal stability and fuels compatibility was shown by W–Re and W–Re–Mo clad W–UO2 systems at all temperatures to 1800 C in helium. The last of a series of in-pile tests of eight W–Re–Mo clad W–UO2 fuel specimens was completed in the ORR with the achievement of leak-free operation for 3400 hours at 1650 C to a burnup of 1.6 × 10 to the 20th power fissions/cu cm without loss of fission products. This improved performance was attributed to end-plenums for storage of fission gases and to the use of lower density cermet fuel cores. Author (NSA)

N70-33152# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
MISTRAL: THERMODYNAMIC UNDULATORY CURRENT ALGORITHM FOR ROD BUNDLE (16740) [MISTRAL: THERMODYNAMISCHER MISCHSTROEMUNGSALGORITHMUS FUER STABBUENDEL (16740)]
W. Baumann Jun. 1969 36 p refs In GERMAN
(KFK-988) Avail: AEC Depository Libraries

A description is given of a digital computer program for the calculation of the local temperature and mass current in the cooling channels of a fuel element consisting of 61 rods. The computer method considers that the temperature difference between the central and near the wall cooling channels was affected by expansion, heat conductivity, and cross mixing of the coolant. For configuration of the method, studies were used which serve for the determination of the coolant cross mixing in air-cooled rod bundles. It was shown that a good agreement exists between he digitally calculated and the measured temperature profiles. The calculation method was also used for bundles of various clearance holders with sodium, steam, and helium as coolant. The method offers the possibility of estimating the case of thermal oblique load which is experimentally difficult to determine. Author (NSA)

N70-33153# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
EFFECTIVITY AND COST OPTIMIZATION OF SAFEGUARDS SYSTEMS, PART 2
R. Avenhaus and D. Gupta Aug. 1969 34 p refs Presented at IAEA Working Panel on Systems Analysis, Vienna, 25-29 Aug. 1969
(KFK-1101; CONF-690826-1) Avail: AEC Depository Libraries

The method for defining the effectiveness of safeguards systems is developed which does not require any prior knowledge of the relation between probability of detection and the amount assumed to be diverted. It requires a prior knowledge only of the measuring errors and other technical conditions, which may influence a diversion. This method also gives a criterion according to which the utilization of safeguards budget can be optimized. A number of other conclusions can be drawn based on the analysis given. The effectivity defined is for a single nuclear facility. For developing the concept of effectiveness for a safeguards system covering a number of facilities or a fuel cycle, the fact that fissile material will have different values in different facilities (effective kgs), will have to be taken into consideration. The definition of effectivity is based on the detection in case of a diversion. However, the question of prevention has also been touched by introducing the concept of critical time, which compels an inspection authority to take an inventory and complete a material balance before a certain time has lapsed. Author (NSA)

N70-33155# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
ADJUSTMENT AND VACUUM TESTS OF A SERIES OF ELECTRO-DISCHARGING TITANIUM PUMPS, NEM-IT, FOR THE PROTON I-100 LINEAR ACCELERATOR
M. K. Bulgakov, V. G. Rogozinskii, and V. L. Ushkov 1969 18 p refs In RUSSIAN
(IFVE-SKU-69-38) Avail: AEC Depository Libraries

The development and testing of various conditioning procedures for the NEM-1T pumps for the I-100 proton linear accelerator are discussed. Author (NSA)

N70-33158# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
EXPERIMENTAL LOOP: SKODA
Jan. Martinek and Karel Novotny [1969] 16 p
(NP-18146) Avail: AEC Depository Libraries

An experimental loop of the Nuclear Power Plant Division of SKODA Concern is described. The facility is presently assigned to research and testing of the gas-cooled nuclear reactor components under operational parameters, and to conduct research and tests of the fuel elements, control mechanisms and elements, pressure tube channels, and other components of the primary circuits of the nuclear power plant. The unit may be converted for testing components of the advanced gas-cooled converter and gas-cooled fast reactors. The working medium of the loop is CO2. Engineering drawings are included. NSA

N70-33159# Technische Hochschule Munchen (West Germany). Inst. fuer Mess- und Regelungstechnik.
CRITICAL AND SAFE PARAMETERS FOR PLUTONIUM AND PLUTONIUM COMPOUNDS
Thomas Wolfgang Apr. 1969 40 p refs
(MRR-56) Avail: AEC Depository Libraries

Critical and safe parameters (mass, concentration, volume, diameter of infinite cylinder, diameter of infinite slab) have been established for plutonium and plutonium compounds. In all cases full reflection is assumed. The plutonium fuel is pure Pu-239. A review of plutonium literature is given and criticality calculations were made by means of the DTF-transport code using four and sixteen energy groups. NSA

N70-33193# Bhabha Atomic Research Centre, Bombay (India).
IN-REACTOR ELECTRICAL RESTIVITY MEASUREMENTS ON THORIUM DIOXIDE
A. M. George, M. D. Karkhanavala, and A. Harvey 1969 9 p refs
(BARC-436) Avail: AEC Depository Libraries

An experimental setup to study the resistivity changes of thorium oxide during reactor irradiation is described. The assembly, located at the CIRUS, permits irradiation of the samples in a range of neutron fluxes. Thermoelectric power measurements can also be made on semiconducting ceramics having fairly high Seebeck coefficients. Results of some preliminary experiments carried out on sintered thorium oxide and thorium oxide doped with 2 mole % calcium oxide are presented. Author (NSA)

N70-33194# Lyon Univ. (France). Institut de Physique Nucleaire.
MICROSTRUCTURE EFFECT ON HYPERFINE INTERACTIONS IN Yb-Ag [INFLUENCE DE LA MICROSTRUCTURE SUR LES INTERACTIONS HYPERFINES DANS Yb-Ag]
R. Beraud, I. Berkes, J. Daniere, R. Haroutunian, G. Marest et al 18 Dec. 1969 18 p refs In FRENCH Supported in part by Direc. Rech. Moyens Essais
(LYCEN-6956) Avail: AEC Depository Libraries

The electronic relaxation time in Tm-169 following the beta decay of Yb-169 embedded in a dilute Yb–Ag–base alloy and in an isotope separator-implanted source, was determined by time-differential and integral perturbed angular correlation measurements at room temperature. An electric field gradient acting on the Tm-169 nucleus was discovered in the alloy, too. These results are thought to come from the precipitation of Yb and the formation of YbAg2 in the dilute alloy. NSA

N70-33199# United Kingdom Atomic Energy Authority, Dounreay (Scotland). Reactor Group.
DIAMETER MEASURING JIG FOR IRRADIATED FUEL PINS
A. Robertson and J. K. Butler Mar. 1970 9 p
(TRG-1977) Avail: AEC Depository Libraries

A jig is described which has successfully been used for several years to measure the diameter of D.F.R. experimental fuel pins. An improved version which performs automatically under the control of a cam-operated timer is also described. In both cases the output is in the form of digital display. Author (NSA)

N70-33212# Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan). Plutonium Fuel Development Lab.
PLUTONIUM FUEL DEVELOPMENT, VOLUME 5 Semiannual Report, Jul. – Dec. 1968
1 Apr. 1969 216 p refs Transl. into ENGLISH from Japan. Rept. PNC-N-851-69-9005
(JAPFNR-6) Avail: AEC Depository Libraries

Research and development progress is reported on design of fuel assemblies for in-pile testing, preparation of UO2–PuO2 fuels, power distribution for critical experiments with PuO2–UO2 lattices, radiation effects on PuO2–UO2 fuel specimens, thermal diffusivity of UO2 and PuO2–UO2 fuel specimens, thermal conductivity of Vipac UO2 fuel, phase studies of Pu–O–U, mechanical properties of fuel pins, fissile material accountability, gamma spectrometric determination of PuO2, and personnel radiation protection. NSA

N70-33219# Los Alamos Scientific Lab., N.Mex.
PROCEEDINGS OF SYMPOSIUM ON ENGINEERING PROBLEMS OF FUSION RESEARCH
Jan. 1970 354 p refs Symp. held at Los Alamos, N.Mex., 8-11 Apr. 1969
(Contract W-7405-eng-36)
(LA-4250; CONF-690407) Avail: CFSTI

Papers are presented on the following areas of investigation: ring conductor experiments, systems and data acquisition, components and technology, control and instrumentation, vacuum and unique devices, power supplies and power technology, Scyllac design and instrumentation, and magnetic fields and coils. N.E.N.

N70-33231# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EL 4: BALANCE OF REACTIVITY TO POWER REACTOR EVOLUTION [EL 4-BILANS DE REACTIVITE EN PUISSANCE EVOLUTION DU REACTEUR]
Noselle Goix and Marcel Chabrillac Jan. 1970 83 p refs In FRENCH
(CEA-N-1242) Avail: AEC Depository Libraries

The results of neutronic tests performed on EL 4 reactor operating at power are collected and comparisons are made with calculations performed under the same conditions. The effects of soluble poison, control rods, Xe, Sm and Rh poisoning, and heavy water temperature are studied. Temperature or power coefficients of the reactor are deduced from a comparison of two stable states: on power and cold state. The study of fuel evolution, from the startup til a shutdown at 64 equivalent days on power is discussed. This study was made by means of cold reactivity balances, of an experiment at stable operation and of flux maps. Author (NSA)

N70-33247# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
FIRST IRRADIATION EXPERIMENTS ON UO2-MO AND UO2 Cr CERMETS WITH 80 VOLUME PERCENT UO2 IN Nb CANS [ERSTE BESTRAHLUNGSVERSUCHE AN UO2-MO- UND UO2-CR-CERMETS MIT 80 VOL PERCENT UO2 IN NB-HUELLEN]
W. Dienst and P. Weimar 2 Oct. 1969 42 p refs In GERMAN
(NP-18151) Avail: AEC Depository Libraries

For irradiation tests, small fuel-rod specimens were prepared of UO2–20 vol% Mo and UO2–20 vol% Cr cermets with Nb-cladding. An idealized cermet microstructure was obtained by isostatic hot-pressing metal-coated UO2 microspheres (about 100 micrometers diameter). Their properties were characterized by data on the bending strength, thermal conductivity, and thermal expansion of such cermets as functions of their metal content. 16 specimens of about 6.5 mm fuel diameter, 40 mm fuel length, 0.3 mm cladding thickness and 75 to 100% TD pressed density were irradiated in two NaK-filled capsules. The average rod-power was about 550W/cm, the cladding temperature 650 C, the uranium burnup 1 to 1.5%. UO2–Mo samples of 75% TD tended to microcracking in the Mo-matrix. On the other hand, samples of very high density near 100% TD underwent cladding cracks by fission-product swelling of the fuel. The optimum density for avoiding fission gas release and swelling of the fuel rods appears to be 85 to 90% TD. Author (NSA)

N70-33260# Allgemeine Elektricitaets-Gesellschaft, Grosswelzheim (West Germany). Fachgebiet Schnelle Reaktoren.
DEVELOPMENT PROGRAMME: FAST CORE FOR THE SUPERHEATER REACTOR (HDR) [ENTWICKLUNGSPROGRAMM: SCHNELLER KERN IM HDR]
A. C. Stumpe Bundesministerium fuer Bildung und Wiss. Dec. 1969 134 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Bildung und Wiss.
(BMBW-FBK-69-46) Avail: AEC Depository Libraries

Development and project investigations analyzing the possibilities of a reconstruction of the superheat reactor HDR as a testbed for fuel rods of steam cooled fast reactors are reviewed. The plan of a second core for the HDR consisting of an outer thermal and a central fast zone ran into difficulties concerning safety aspects. The intention of fitting a small steam cooled fast reactor into the HDR-pressure vessel turned out as unproportionally expensive. Therefore the plan of reconstructing the HDR was dropped in favor of an independent test reactor. Author (NSA)

N70-33276*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF EXPERIMENTAL AND CALCULATED CRITICAL MASSES FOR A GAS CORE CAVITY REACTOR
Klaus H. Gumto Washington Jul. 1970 22 p refs
(NASA-TM-X-2055; E-5320) Avail: CFSTI CSCL 18K

Experimental critical masses for a cylindrical cavity reactor with simulated gaseous fuel are compared with calculated critical masses for similar reactor configurations. Both diffusion and one- and two-dimensional transport theory computer codes were employed in five distinct sets of calculations. By varying input parameters such as number of broad energy groups and number of mesh intervals from one set to another, the effect of the changes on the accuracy of the calculations was determined. Author

N70-33281# Institute of Nuclear Research, Warsaw (Poland).
INVESTIGATION OF FISSION PRODUCT RELEASE FROM CARBON-COATED FUEL PARTICLES [BADANIA UCHODZENIA PRODUKTOW ROZSZCZEPIENIA Z PALIN ZIARNISTYCH POWLEKANYCH WEGLEM PIROLITYCZNYM]
Krystyna Jozefowicz 1969 19 p refs In POLISH
(INR-1125) Avail: AEC Depository Libraries

The mechanism of fission product release from irradiated grain fuels at various temperatures is described. Various methods used for fission product release measurement are reviewed. Two methods are described to examine UO2 or UC2-type grain fuels coated with pyrolytic carbon. The first method, based on the measurement of fission iodine release from irradiated fuel samples into water at a temperature less than 100 C, is suitable for rough estimation of fuel coating performance. The second method, a high temperature one, is based on the measurement of fission xenon release from irradiated fuel samples during heating at a 1100 C. Author (NSA)

N70-33290*# Techtran Corp., Glen Burnie, Md.
BEHAVIOR OF METALLIC BERYLLIUM IN SM-2 REACTORS [POVEDENIE METALLICHESKOGO BERILLIYA V REAKTORE SM-2]
Z. I. Chechetkina et al Washington NASA Jun. 1970 12 p refs Transl. into ENGLISH of Sci. Res. At. Reactor Inst., Melekess, Report P-20
(Contract (NASw-2037)
(NASA-TT-F-13064) Avail: CFSTI CSCL 18J

The results of an investigation of the behavior of metallic beryllium in the SM-2 reactor indicate that: (1) low temperature irradiation does not result in any significant volume changes in hot pressed and hot extruded beryllium; (2) strength decreases and the material becomes brittle when microfissures appear; (3) an increase in microhardness and a decrease in plasticity are the results of the helium atoms being in a quasidissolved state in the form of interstitial atoms; and (4) the admissable dose of irradiating beryllium parts is approximately 2 × 10 to the 22nd power barns/sq cm. Author

N70-33307# Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan).
OUTLINE OF THE JAPAN EXPERIMENTAL FAST REACTOR
[1969] 24 p
(JAPFNR-7; PNC-N-141-69-14) Avail: AEC Depository Libraries

The background of the planning for construction of the Japan Experimental Fast Reactor (JEFR) is presented. The JEFR was designed to be a 100 MW(t) sodium-cooled fast breeder with PuO2 – UO2 fuel. The site at Orari and the various reactor systems are described. NSA

N70-33308# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
POLICY OF CEA IN MATTERS OF DESIGN, MANAGEMENT, AND SECURITY OF INSTALLATIONS OF HIGH ACTIVITY
R. Mas [1969] 29 p refs In FRENCH Presented at the Symp. on Radiation Safety Probl. in the Design and Operation of Hot Facilities, Saclay, France, 13-19 Oct. 1969
(CEA-CONF-1429; SM-125/49; CONF-691008-12) Avail: AEC Depository Libraries

For each of the various categories of hot installations in France, an outline is given of the evolution of the ideas adopted for the construction of these C.E.A. installations. The French conception of the security of personnel, particularly in the case of hot installations, is then examined. The principles, methods, and procedures which were satisfactory and which can be adopted for future installations are reviewed. NSA

N70-33314# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
TWO YEARS WORK OF THE RADIOMETALLURGY LABORATORY AT FONTENAY-AUX-ROSES [DEUX ANS D'EXPLOITATION DU LABORATOIRE DE RADIOMETALLURGIE A FONTENAY-AUX-ROSES]
L. Hayet and A. Poulain 1969 18 p refs In FRENCH Presented at the Intern. Symp. on Radiation Safety Probl. in the Design and Operation of 'Hot' Facilities, Saclay, France, 13-17 Oct. 1969
(CEA-CONF-1422; Conf-691008-10) Avail: AEC Depository Libraries

A radiometallurgical laboratory, RM 2 is operated at Fontenay-aux-Roses for the examination of fuels from French fast neutron reactors and for the study of prototype fuels with irradiated Pu. After a brief description of the installations from the viewpoint of security, the principles concerning radiological controls, fire detectors, personnel equipment, coordination of operations, decontamination of cells, and transfer of radioactive material are described. Conclusions are drawn from the two years' operation and orientation of the modifications now being made is indicated. Author (NSA)

N70-33319# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
EXPERIMENTAL INVESTIGATION OF THE LOSS OF PRESSURE AND OF THE LONG-TERM BEHAVIOR OF THE REINFORCED PLACE IN A MODEL FUEL ELEMENT WITH AN INCOLOY 800 TUBE WITH SIX INTEGRALS SPIRALS AS SPACERS IN AN ISOTHERMAL STREAM OF SUPERHEATED STEAM [EXPERIMENTELLE UNTERSUCHUNGEN DES DRUCKVERLUSTES UND DES LANGZEITVERHALTENS DER ABSTUETZSTELLEN AN EINEM MODELL-BRENNELEMENT AUS INCOLOY 800-ROHREN MIT SECHS INTEGRALEN WENDELRIPPEN ALS ABSTANDSHALTER IN EINER ISOTHERMEN HEISSDAMPFSTROEMUNG]
H. Hoffmann, G. Hofmann, and S. Leistikow Aug. 1969 68 p refs In GERMAN
(KFK-1028; EUR-4304.d) Avail: AEC Depository Libraries

As fuel elements for fast breeder reactors, Incoloy-800 tubes with spirals serving as cooling fins and spacers are presently under consideration. To study the behavior of such elements under simulated operating conditions a model with 37 fuel element bundles was constructed and was tested up to 500 hours with isothermal steam of 505 C, 130 atm pressure, and Reynold numbers ranging from 65,000 to 220,000. After conclusion of the test, the elements were studied as to metal loss through oxidation and deformation of the cooling fins. It was concluded that the spiral arrangement is suitable for steam-cooled reactors. NSA

N70-33338# Oak Ridge National Lab., Tenn.
TISSUE DOSIMETRY OF RADIATION GENERATED BY HIGH ENERGY ACCELERATORS
V. T. Golovachik et al [1970] 10 p refs Transl. into ENGLISH from Russian Doct. JINR-P16-4765
(ORNL-TR-2286) Avail: CFSTI

Application of spherical tissue-equivalent proportional counters for measurement of the linear energy transfer dose spectra in the scattered radiation fields of the 70 GeV proton synchrotron (IPHE) is described. Also, the tissue depth-dose distributions in the scattered radiation fields of the JINR synchrocyclotron were measured. Author (NSA)

N70-33345# Kernforschungszentrum, Karlsruhe (West Germany).
DESCRIPTION OF A CONTROL EXPERIMENT IN THE EUROCHEMIC REPROCESSING FACILITY
R. Kraemer, A. V. Baeckmann, A. Hagen, D. Nentwich, W. Coedt et al Jul. 1969 108 p In GERMAN
(KFK-907) Avail: AEC Depository Libraries

A control experiment was set up at the EUROCHEMIC reprocessing plant in order to apply the theoretical results of a systematic analysis of the reprocessing and to test the functioning of newly developed instruments and measurement methods. The aims of the control experiment were to plot a Pu balance independent of operator data and to compare it with the balance of the operators, to select only a small number of strategic points for control studies, to obtain defined initial and final conditions by extreme cleaning of the installation, to make error analyses of the instrumentation and chemical analysis methods used, to compile the practical results in order to design a future monitoring system in reprocessing plants, and evaluate the results by a computer program, and to determine the significance of strategic points with respect to expenditure and data obtained in order to establish priorities for the development of future measurement and analysis methods. NSA

N70-33348# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

TECHNIQUES AND MEANS TO PUT INTO ACTION AT CEN FOR DISMANTLING OF HIGH-ACTIVITY CELLS AND IN-SHOP DECONTAMINATION OF THEIR EQUIPMENT

J. Bourdrez, Y. Marque, B. Roger, E. Bertrand, and L. Peronnet [1969] 27 p In FRENCH Presented at the Symp. on Radiation Safety Probl. in the Design and Operation of Hot Facilities, Saclay, France, 13-19 Oct. 1969

(CEA-CONF-1425; SM-125/18; CONF-691008-7) Avail: AEC Depository Libraries

The total or partial dismantling of high-activity cells requires particular techniques adapted to the evaluated risks of irradiation and contamination. The general principles observed for the dismantling of the high-activity cells are reported. The methods used to verify some previously drawn conclusions are then reviewed on the basis of specific examples. The installation and methods used in the workshop for receiving and processing a large part of the contaminated materials from the high-activity cells are described. The installations consist principally of a shielded cell designed for pre-decontamination and of dismantling of contaminated equipment of large dimensions. There is also a large room adapted for work in protective clothing. The equipment used for the protection and monitoring of the operators are reviewed. The results obtained during ten months of operation are reviewed and evaluated. Author (NSA)

N70-33349# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Energia Nuclear.

DIFNE: FORTRAN PROGRAM LFEN-FR5. CALCULATION OF NEUTRON FLUX IN SUBCRITICAL ARRAYS [DIFNE: PROGRAM FORTRAN LFEN-FR 5. CALCULO DE FLUXOS NEUTRONICOS EM CONJUNTOS SUBCRITICOS]

Jose F. Salgado and Jorge H. Machado 1969 29 p refs In PORTUGUESE

(LFEN-NI.43/ALPHA/) Avail: AEC Depository Libraries

DIFNE is a program for calculating the neutron flux distribution in subcritical assemblies with cylindrical geometry. The program, based on two-group diffusion theory, calculates the fast and thermal flux in the axial, radial, and azimuthal directions. The fundamental theory and the program listing are presented. NSA

N70-33350# Commissariat a l'Energie Atomique, Marcoule (France). Centre de Production de Plutonium.

INTERVENTION IN A HIGH ACTIVITY CELL WITH THE AID OF A HEAVY TELEMANIPULATOR [INTERVENTION DANS UNE CELLULE DE HAUTE ACTIVITE AVEC L'AIDE D'UN TELEMANIPULATEUR LOURD]

Andre Calame-Longjean 1969 28 p refs In FRENCH Presented at Intern. Symp. on Radiation Safety Probl. in the Design and Operation of "Hot" Facilities, Saclay, France, 13-17 Oct. 1969

(CEA-CONF-1412; CONF-691008-8) Avail: AEC Depository Libraries

A detailed description is given of the different phases and methods for the partial changing of a fission product concentration evaporator and to improve some parts of the chemical installation in one of the high-activity cells for the processing of irradiated fuel elements. The cell, its equipment, and the telemanipulator used are described. Corrosion of a stainless steel intake valve necessitated the repairs. The methods used for the internal decontamination of the cell are described chronologically. The efficiency of the decontamination is evaluated. The telemanipulation techniques used during the repairs are discussed. The operation was costly in terms of integrated doses for personnel, decontamination of the cell, and maintenance of the intervention apparatus. NSA

N70-33352# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.

NEPTUNIUM ANALYSIS IN NUCLEAR FUEL ELEMENTS [NEPTUNIUM-ANALYSE IN KERNBRENNSTOFFEN]

H. Braun, B. Brandalise, and L. Koch Nov. 1969 14 p In GERMAN

(KFK-1115; EUR-4319.D) Avail: AEC Depository Libraries

A method is described for separation of Np from U, Pu, and fission products. In the presence of a strong reducing agent in 8M HNO3 only Np is adsorbed on an anion exchange column. The Np was further purified by solvent extracting using TTA. Isotopic dilution analysis with NP-239 as indicator was used to calculate yields. No absolute measurement of Np-237 activity in the sample is necessary. NSA

N70-33362# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

IRRADIATION RESULTS OF MIXED UO2-PuO2 OXIDE TEST PIECES FOR FAST NEUTRON REACTOR FUEL ELEMENTS

Hubert Mikailoff et al Oct. 1969 63 p refs Transl. into ENGLISH from French report CEA-R-3878 Sponsored by the USA-EURATOM Fast Reactor Exchange Program

(EURFNR-707; EUR-4323.fl CEA-R-3878) Avail: CFSTI

Thermal flux irradiation testing of small mixed oxide pellet (U-Pu)02 fuel elements were performed in support of the fuel reference design for the Phenix fast reactor. The effects of different parameters (stoichiometry, pellet density, pellet clad gap) on the behavior of the oxide (temperature distribution, microstructural changes, fission gas release) were investigated in various irradiation conditions. The effect of fuel density decrease and power rate increase on thermal performances were determined on short term irradiations of porous fuels. Author (NSA)

N70-33364# Kernforschungszentrum, Karlsruhe (West Germany). **REPORT ON THE SAFETY ANALYSIS OF THE FAST SODIUM-COOLED REACTORS [BEITRAEGE ZUR SICHERHEITSANALYSE DES SCHNELLEN NATRIUMGEKUEHLTEN REAKTORS (NR)]**

K. Gast, K. Keller, W. Peppler, W. Schikarski, E. G. Schlechtendahl et al Aug. 1969 37 p refs

(NP-18150) Avail: AEC Depository Libraries

Failure propagation and accidents in fast sodium cooled fuel elements are discussed. Methods by which failure propagation occurs are considered. Effects on the sodium coolant boiling in-core are analyzed; sodium boiling experiments for determining thermodynamic and neutronics behavior are described. Radioactivity release under accident conditions in a sodium cooled fast reactor is evaluated; aerosol and particulate generation and transport under accident conditions are analyzed. Incipient and pool boiling mechanisms are discussed; effects of sodium vapor formation are considered. NSA

N70-33368# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.

COMPARISON OF LONG AND SHORT COMPATIBILITY

TESTS ON UN AND UO2 [VERGLEICH VON LANG- UND KURZZEITVERTRAEGLICHKEITSUNTERSUCHUNGEN AN UN UND UO2]
O. Goetzmann and W. Hein Nov. 1969 10 p refs In GERMAN; ENGLISH summary
(KFK-1086) Avail: AEC Depository Libraries

Compatibility tests were performed on the cladding materials vanadium, VTi5Nb2O, VTiIO, VTi2O, stainless steel (XCrNiTi 18/9), Incoloy 800 (Nicrofer), Incoloy 625 and Inconel 718 with nuclear fuels UN and UO2. The test temperatures were at 760 and 800 C, and the annealing time was 1000 hr. The behavior of the different compatibility couples is described and compared with the results of former, more systematic compatibility tests where the annealing times were a maximum of 144 hr. The conclusions drawn from these short-time-test results for the compatibility behavior of the different systems are supported by these investigations fairly well. Only the results of Incoloy 800 (Nicrofer) with UN as well as UO2 differed from those that were expected. Author (NSA)

N70-33369# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
PREPARATION AND PROPERTIES OF CERMETS WITH IDEALIZED STRUCTURE IN THE SYSTEM UO2/Cr [HERSTELLUNG UND EIGENSCHAFTEN VON CERMETS MIT IDEALISIERTEMGEFUEGE IM SYSTEM UO2/CR]
P. Weimar and F. Thuemmler Dec. 1969 21 p refs In GERMAN
(KFK-1112) Avail: AEC Depository Libraries

The fabrication and some properties of UO2–Cr cermets with idealized structure and metal content of 6 to 30 vol % are discussed. The results are compared with those for UO2–Mo cermets. The reasons for the appearance of a distrubed microstructure specially at small metal contents, for a smaller thermal conductivity and for a low strength for UO2–Cr cermets are discussed. The minimum in bend–strength observed for cermets with high UO2–investment is described. Future experiments are sketched. Author (NSA)

N70-33377# Atomics International, Canoga Park, Calif.
AEC UNCLASSIFIED PROGRAMS Quarterly Technical Progress Report, Jul.–Sep. 1967
24 Mar. 1970 210 p refs
(Contract AT(04-3)-701)
(NAA-SR-12570) Avail: CFSTI

Progress is reported for work done in the following areas: cross section analysis, fast spectrum Doppler measurements, basic theory calculation, integral reactor physics measurements, fission product contamination and control studies, sodium fire fission product release, boiling studies for sodium reactor safety, coolant management, materials management, dynamic loop testing, modes of failure and helium degradation, carbide fuels research and development, and radiation chemistry. J.M.C.

N70-33393# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
A VARIABLE GEOMETRY SEPARATOR AND LOW ENERGY HEAVY ION ACCELERATOR. PART 1: GENERAL PRINCIPLES
J. H. Freeman Jan. 1970 21 p refs
(AERE-R-6254) Avail: AEC Depository Libraries; HMSO 5s 6d; BIS$1.10

The new Harwell isotope separator and heavy ion accelerator was designed as a compact laboratory facility for the separation of high purity isotopes as well as for a wide range of ion interaction studies. The novel focusing arrangements permit considerable experimental flexibility, with a resolution and dispersion comparable with much larger conventional separators. The high beam intensity of the machine is adequate for production-scale semiconductor doping. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-32092# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC FOCUSING OF A VIDICON BEAM
M. S. Samarin 4 Mar. 1970 12 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniye (Moscow), v. 12, no. 12, 1968 p 48–50
(AD-704765; FTD-MT-24-344-69) Avail: CFSTI CSCL 17/2

Considered is the influence of magnetic field variations of the focusing coil and focusing electrode potential on the focusing quality of electronic beam. Defined is the covering area of automatic focusing system. Author (TAB)

N70-32311# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Fluid Mechanics Section.
ELECTRIC FIELD MODIFICATION OF TURBULENCE IN A FLUID CONTAINING SPACE CHARGE
A. Loeffler Jul. 1970 32 p
(RE-384) Avail: CFSTI

The effect of a gradient in electric charge density and an electric field on the decay of homogeneous turbulence is examined. By making suitable simplifying assumptions, such as that of weak turbulence, the governing equations can be reduced to a form for which a solution for the three dimensional Fourier transform exists. Subsequent integrations of the three dimensional transform to obtain the one dimensional transform and also to obtain expressions for the total turbulence energy are carried out. Both series solutions and simple asymptotic solutions valid for large times (or large electric forces) are presented. The results indicate that when the electric field is in the direction of incressing charge density, the rate of turbulence dissipation is increased. When the electric field is in the opposite direction, electric field energy is fed into the turbulence and the turbulence increases without limit in time instead of dying out. Examination of the one dimensional spectra shows that it is the large eddies that grow in the latter case. As an example, the turbulence amplification which can occur in thunderstorms is discussed. Author

N70-32518# Bayerische Akademie der Wissenschaften, Munich (West Germany). Mathematisch-Naturwissenschaftliche Klasse.
ADIABATIC INVARIANCE OF THE FUNCTIONAL INTEGRAL FOR MOTION IN NON-REGULATED FORCE FIELDS [ADIABATISCHE INVARIANZ DES WIRKUNGSINTEGRALS FUER DIE BEWEGUNG IN NICHT-REGULAEREN KRAFTFELDERN]
Dieter Pfirsch and Karl Schindler 1969 14 p refs In GERMAN
Avail: CFSTI

The acceleration of particles in interstellar space to relativistic velocities is considered by analyzing the Fermi mechanism which uses repeated reflections of approaching magnetic field inhomogeneities to obtain higher energies. Thus, the energy reaching the variance parallel to the magnetic field is subsequently distributed to the other two variances by destroying the adiabatic invariance of the magnetic moment. It is shown that shock waves expanding exactly vertical to the magnetic field cannot destroy the magnetic moment. Transl. by G.G.

N70-32666# Stanford Univ., Calif. Dept. of Mathematics.
ON THE PROBLEM OF CLOSELY SEPARATED CIRCULAR DISCS AT EQUAL POTENTIAL
Frank Leppington (Imperial College, London) and Harold Levine 20 Jan. 1970 42 p refs

(Contract Nonr-225(74))
(AD-705131; SU-TR-15) Avail: CFSTI CSCL 20/3

A pair of identical and coaxially aligned circular discs is maintained at unit potential, inducing a common axisymmetric charge distribution on their respective surfaces. An approximate solution of the related boundary value problem is sought when the ratio epsilon of separation against diameter is small, with particular emphasis given to the asymptotic development of the total charge C on each disc. A crude estimate therefore, C approximately equal to 1/pi, obtains readily on the basis of an intuitive argument which identifies the potential field for narrowly separated discs with that of a coincident pair and assigns to each one-half of the density (or total charge) found on the limiting surface at the assigned potential. More precise results are obtained, firstly, by using the particulars of the single disc field distribution in a complementary pair of variational principles, and secondly, by relying on a uniformly accurate characterization of the potential over the whole plane containing one of the discs, which evidences different behaviors for points close to and far from the edge, respectively. TAB

N70-32687# Compagnie Generale de Telegraphie sans Fil, Orsay (France). Lab. Central Thomson.

OPTICAL PROCEDURE FOR EXAMINING SIGNAL FORMS AND RECEPTION [LE TRAITEMENT OPTIQUE DANS LES DOMAINES DE LA RECONNAISSANCE DES FORMES ET DE LA RECEPTION DES SIGNAUX]

Jean Dansac *In* AGARD Opto-Electron. Signal Process. Tech. Feb. 1970 8 p In FRENCH (See N70-32686 17-16)
Avail: CFSTI

A description of methods for the examination of forms and treatment in real time of electrical signals is given. Particular emphasis is placed on the classification of treatment procedures for electro-optics. Treatment procedures classified included: treatment in different times on large information quantum, treatment in different times on small quantum, treatment in real time on long quantum, and treatment in real time on short quantum. Transl. by J.M.C.

N70-32722*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL DETERMINATION OF APPARENT MASS AND MOMENT OF INERTIA OF A LARGE DISK SUSPENDED AS A PENDULUM AT DIFFERENT AIR DENSITIES

Robert S. Dunning Washington Jul. 1970 26 p refs
(NASA-TN-D-5897; L-7052) Avail: CFSTI CSCL 20D

An experiment was performed to measure the apparent mass of air and added moment of inertia of the air associated with a freely swinging disk pendulum. The results were used to determine the mass coefficients associated with rotation about an axis of the disk and with translation. These experimental results are compared with theoretical values. Author

N70-32746# Argonne National Lab., Ill.

OPTICAL PROPERTIES OF DOSIMETRIC CRYSTALS OF LITHIUM FLUORIDE [OPTICHESKIE SVOISTVA DOSIMETRICHESKIKH FTORISTOGO LITIYA]

M. M. Grube et al Mar. 1970 11 p refs Transl. into ENGLISH from Latvijas PSR Zinatu Akad. Vestis, Fiz. Teh. Zinat. (RIGA), No. 4, 1968 p 7–12
(ANL-Trans-812) Avail: CFSTI

Color centers and luminescence of LiF:Mg, Ca crystals applied to thermoluminescence dosimetry were studied. The thermoluminescence curve contains eight peaks: 140 C, 175 C, 200 C, 240 C, 290 C, 330 C, 400 C and 480 C. The peaks at 140 C, 175 C and 200 C are connected with supplementary absorption bands in the region 240 to 400 nm. The maximum intensity peak at 240 C and the high-temperature peaks are connected with the F-band and neighboring short-wave bands. Four bands (120 nm, 138 to 144 nm, 170 to 190 nm, and 190 to 200 nm) are detected in the excitation spectrum. The maximum of the emission spectrum is located in the 410 nm region. Author (NSA)

N70-32888# Wyle Labs., Inc., Huntsville, Ala.

THE NOISINESS OF DIFFUSE SOUND FIELDS AT HIGH INTENSITIES Final Report

J. B. Ollerhead Aug. 1969 102 p refs
(Contract FA-68-WA-1971)
(FAA-NO-70-3) Avail: Issuing Activity

An experimental study was conducted to establish the relationships between the subjective noisiness, frequency and sound pressure level of random noise in a diffuse acoustic field. The experiments were performed in a fabric enclosure installed within a 100,000 cubic foot reverberant chamber. Twenty-four subjects took part. The growth of noisiness with sound pressure level of an octave band of noise centered at 1,000 Hz was determined. The variation of noisiness with frequency was measured at four perceived noise levels between 78 and 104 PNdB. For comparison purposes, one equal noisiness contour was also determined for free field listening conditions in a progressive wave chamber. The results indicated that currently used noisiness growth functions are adequate but that the equal noisiness contours may need some modification at low frequencies. Also the contour shapes vary as sound pressure level increases indicating relatively greater noise sensitivity at both high and low frequencies. Author

N70-32893*# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.

REFLECTION AND FOCUSING OF SONIC BOOMS BY TWO-DIMENSIONAL CURVED SURFACES

Jack Werner Apr. 1970 55 p refs
(Grant NGL-33-016-119)
(NASA-CR-110727; NYU-AA-69-35) Avail: CFSTI CSCL 20A

An integral relation has been derived describing the pressure due to the reflection of a plane acoustic wave of arbitrary wave form incident on a two dimensional curved surface with plane asymptotes. The results were applied to the problem of sonic boom incident over a reflecting hyperbolic surface. It was found that singularities or focal points occur at which the pressure becomes infinite according to linear theory. A criterion for these focal points to occur was developed and the locus of singularities was determined. The pressure disturbances in the neighborhood of these focal points was investigated for incident step function, linear and N-wave forms. It was found that in the case of the N-wave the major contribution to the disturbance near the focal points comes from the reflection of the discontinuities at the leading and trailing edges of the incident wave. Author

N70-33019# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Tekhnicheskii Inst.

MAGNETIC FIELD AND HIGH FREQUENCY INDUCTION OF A TOROIDAL ENCLOSURE [MAGNITNOE POLE I VYSOKOCHASTOTNAYA INDUKTIVNOST' VLOZHENNYKH TOROV]

M. A. Stotland 1969 18 p refs In RUSSIAN
(NP-18209) Avail: AEC Depository Libraries

Equations are obtained that specify the vector potential, current density, and hf induction for a toroidal enclosure in terms of a combined system of plane and toroidal coordinates for the case when the skin layer is negligibly small. The effect of a gap in the surface of the torus is considered, and the current distribution on the surface of the torus is deduced for the case in which the gap is connected to a source of hf voltage. Author (NSA)

N70-33050*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ERROR IN SPECTRAL MEASUREMENTS OF SOLAR SIMULATORS ON SURFACE RESPONSE
Henry B. Curtis Washington Jul. 1970 20 p
(NASA-TN-D-5904; E-4913) Avail: CFSTI CSCL 20F

An analysis was made to determine the effect of measurement error in spectral distributions of solar simulators. The effect of the error is a change in the calculated total response of a surface (absorptance, reflectance, etc.). Data for six typical spacecraft surfaces and three different solar simulators were used. Author

N70-33170*# Translation Consultants, Ltd., Arlington, Va.
RADIATION FROM TWO PARALLEL CYLINDERS IN A VISCOUS MEDIUM [IZLUCHENIYE DVUKH PARALLEL'NO RASPOLOZHENNYKH TSILINDROV SREDE]
V. N. Buyvol Washington NASA Jun. 1970 12 p refs Transl. into ENGLISH from Prikl. Mekh. (Ukrania SSR), v. 5, no. 10, 1969 p 58–64
(Contract NASw-2038)
(NASA-TT-F-12963) Avail: CFSTI CSCL 20A

Questions dealing with the theory of the radiation and propagation of waves from the surfaces of two parallel circular cylinders in a viscous medium obeying linearized Navier-Stokes equations are discussed. Author

N70-33178*# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
INFORMATION TRANSFER FROM INCOHERENTLY RADIATING OBJECTS
Carl W. Helstrom 1970 33 p refs
(Grant NGL-05-009-079)
(NASA-CR-109772) Avail: CFSTI CSCL 20F

The mutual information between the radiance of an incoherently radiating object plane and the field at the aperture of an observing system is calculated on a classical basis. A formula of the Shannon type is obtained when the time-bandwidth product of the object light is large, the average radiance from the object plane is small enough to permit the threshold approximation, and the radiance of the object plane is modeled as a spatial Gaussian process. It includes the dependence on the bandwidth of the object light and the effective temperature of the background, assumed spatially and temporally white. A set of sufficient statistics for the aperture field, based on Fourier sampling of the object plane, is introduced, and its bearing on the resolution of fine details of the object is brought out. Author

N70-33320# Northrop Corp., Hawthorne, Calif. Corporate Labs.
ATTENUATION OF SOUND IN ROCKS Final Report, 20 Mar. 1968 – 31 Mar. 1970
Richard D. Tooley Apr. 1970 65 p refs
(Contract F19628-68-C-0319)
(AD-704821; NCL-70-21; AFCRL-70-0198) Avail: CFSTI CSCL 8/7

A technique is presented whereby measurements of compressional and shear wave velocities and attenuations can be measured over a pressure range from 1 bar to 15 kilobars and over a temperature range from 25 to 1300 degrees Celsius. Compressional wave measurements were made on a basalt, and obsidian, and a limestone. The consistent finding is that the compressional Q decreases markedly in the melting temperature region. Author (TAB)

N70-33337# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT Semiannual Progress Report, 1 Jul. – 30 Dec. 1969
C. N. Watson-Munro 30 Dec. 1969 9 p Supported in part by Australian Govt.
(NP-18193; PR-18) Avail: AEC Depository Libraries

Research work carried out during this period is briefly summarized. In particular, the work covered the following areas: (1) plasma sources, (2) hydromagnetic ionizing fronts; (3) hydromagnetic waves in nonuniform magnetic fields; (4) laser diagnostics; and (5) far-infrared. NSA

N70-33373# Maryland Univ., College Park. Inst. for Fluid Dynamics.
DISAPPEARING BOUNDARIES. SIMULTANEOUS DISCOVERIES
Stephen G. Brush Feb. 1969 27 p Presented on Can. Broadcasting Corp. Radio, 10-17 Jan. 1969
(BN-597) Avail: CFSTI

The concept of boundaries between objects down to the atomic level is discussed. The question is posed whether a boundary can be definitely defined or whether the boundary of one object gradually blends into that of another. It is concluded that the boundary between matter and space is an artifical boundary created by the human mind in the same manner as the boundary between science and philosophy exists. The phenomenon of simultaneous discoveries by different scientists at different locations is discussed. Various theorems are advanced to account for the factors influencing simultaneous discovery. The recurrence theorem that every state of the universe has occurred an infinite number of times in the past and will occur an infinite number of times in the future is cited as another boundary between philosophy and science. R.B.

N70-33389*# Techtran Corp., Glen Burnie, Md.
DISTRIBUTION OF ELECTRICITY ON A THIN FINITE CONE [RASPREDELENIYE ELEKTRICHESTVA NA TONKOM KONECHNOM KONUSE]
N. N. Lebedev et al Washington NASA Jul. 1970 15 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz. (Moscow), v. 9, no. 6, 1969 p 1336–1346
(Contract NASw-2037)
(NASA-TT-F-13016) Avail: CFSTI CSCL 20C

A method is proposed based on reducing the problem to a simple second-order Fredholm integral equation with symmetric kernel, by reducing it to paired integral equations, which (once solved) are used to determine electrical distribution and capacity of the shape. Starting from a cone nearly the shape of a disc, the solution of the integral equation can be constructed in the form of a series of steps of small parameter. The distribution of potential is expressed in quadratures by means of the solutions found, from which are obtained relatively simple formulas for charge density and distribution. This method has come into fairly wide use for the study of peripheral problems in mathematical physics where there are mixed boundary conditions, especially for the charges on thin conductive surfaces of various shapes. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-32001# Oslo Univ. (Norway). Inst. of Physics.
SPIN-ROTATION INTERACTION IN DIATOMIC MOLECULES
L. Veseth [1969] 14 p refs
Avail: CFSTI

A simple operator which is usually assumed to give a proper description of the first order spin-rotation interaction in diatomic molecules, is in the case of Sigma states shown to be strictly

derivable from a fundamental microscopic Hamiltonian given by Van Vleck. In this derivation the electronic screening of the rotating nuclear charges is taken into account. For other types of states it is emphasized that this simple operator only represents an approximation to the true spin-rotation interaction Hamiltonian. Assuming the electronic functions to be given by a Slater determinant of one-electron molecular orbitals, a formula suitable for ab initio calculation of the coupling constant gamma is derived. Author

N70-32060# Turin Univ. (Italy). Inst. of Theoretical Physics.
THEORETICAL WORK IN QUANTUM FIELD THEORY AND ELEMENTARY PARTICLES Final Scientific Report
Sergio Fubini 31 Jan. 1970 8 p refs
(Grant AF-EOAR-68-0015)
(AD-705124; AFOSR-70-1062TR) Avail: CFSTI CSCL 20/8

The group in theoretical physics at the University of Torino has investigated a number of problems connected to the theory of elementary particles, obtaining several interesting results, which are summarized in the body of the report. In particular important contributions have been developed in the fields of current algebra and dual resonance models. Author (TAB)

N70-32071# Ballistic Research Labs., Aberdeen Proving Ground, Md. Nuclear Effects Lab.
PULSE-SHAPE ANISOTROPY IN THE SCINTILLATION RESPONSE OF STILBENE
William P. Bucher and Clinton E. Hollandsworth Feb. 1970 21 p refs
(AD-703855; BRL-1474) Avail: CFSTI CSCL 18/4

The scintillation pulse-shape response of trans-stilbene as a function of the direction of the primary ionizing radiation (5 MeV alpha particles) was measured. The maximum variation of the pulse-shape anisotropy R was found to be less than two percent. Author (TAB)

N70-32072# Oslo Univ. (Norway). Inst. of Physics.
AN IMAGE DETECTOR FOR DISPERSED FLUXES OF ENERGETIC PARTICLES OR gamma-QUANTA EMPLOYING A FIBER-OPTICS DELAY TECHNIQUE FOR ADDRESSED MULTICHANNEL COUNTING
Svein Prydz [1970] 9 p refs
Avail: CFSTI

A one-dimensional image detector for energetic particles or lambda-quanta is described. Principally, the improvement is that of counting simultaneously over a large part of the distribution as opposed to the scanning of a slit using only a minor part of the distribution at a time. The improvement is obtained with no corresponding increase in noise. Author

N70-32256 Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany).
THE MOBILITY OF RARE GAS ATOMS IN NEUTRON-IRRADIATED IONIC CRYSTALS AND NUCLEAR FUEL MATERIALS [ZUR BEWEGLICHKEIT VON EDELGASATOMEN IN NEUTRONENBESTRAHLTEN IONENKRISTALLEN UND KERNBRENNSTOFFEN]
Fred W. Felix Jun. 1970 134 p refs In GERMAN; ENGLISH summary
(HMI-B-93) Copyright. Avail: Issuing Activity

Results obtained up to 1968 from measurements of the post-activation diffusion of rare gases in solids are summarized. The method is presented on the theoretical background and by a detailed description of the experimental technique. Examples are given for typical deviations from ideal diffusion behavior, e.g. the diffusion in an evaporating crystal. Quantitative results are presented on rare gas diffusion in single crystals of alkali halides, alkaline earth fluorides, CsO and nuclear fuel materials (UO_2, UC, ThO_2). Author

N70-32313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL NEUTRON ABSORBER BUILDUP IN IRRADIATED BERYLLIUM
Lawrence E. Peters, Jr. Washington Jul. 1970 14 p refs
(NASA-TM-X-2039; E-5473) Avail: CFSTI CSCL 20H

The differential equations which describe the buildup of thermal neutron absorbers in beryllium have been solved. The solutions were used to calculate the change in the macroscopic absorption cross section of the Plum Brook Reactor as a result of the buildup of these poisons. This calculated value agrees within the experimental error of an actual observed change. The effects of variations in the factors on which the poison is dependent were studied and are presented in the form of graphs. Author

N70-32345*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
OBSERVATIONS OF 8-amu/UNIT CHARGE ION CYCLOTRON WHISTLERS
Donald A. Gurnett and Paul Rodriguez Dec. 1969 12 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144; NAS1-8150; Grant NGR-16-001-043; Contract Nonr-1509(06))
(NASA-CR-110692; Rept-69-56) Avail: CFSTI CSCL 18D

A new type of ion cyclotron whistler associated with ions having a mass-to-charge ratio of 8-amu/unit charge is reported from very-low-frequency (VLF) radio noise observations with the Injun 5 satellite. This observation confirms earlier measurements by the Explorer 31 satellite identifying the presence of 8-amu/unit charge ions in the ionosphere and represents the third type of ion cyclotron whistlers found in satellite VLF data. From crossover frequency measurements the fractional concentration of the 8-amu.unit charge ions has been determined to be a few percent or less. This new ion cyclotron whistler has been observed most often during local night, at altitudes ranging from 1200 km to 2100 km and invariant latitudes from 37 to 58 C. Author

N70-32373# New Mexico Univ., Albuquerque.
A NUMERICAL STUDY OF TRANSPORT PHENOMENA IN SPHERICAL GEOMETRY BY THE METHOD OF INVARIANT IMBEDDING Final Report
R. C. Allen, Jr., L. F. Shampine, and G. M. Wing Washington DASA Apr. 1970 88 p
(Contract DASA01-69-C-0119)
(AD-705150; DASA-2421) Avail: CFSTI CSCL 20/8

For several years the method of invariant imbedding has been used in the numerical study of transmission and reflection properties of materials subjected to flux of particles (neutrons, protons, etc.). In the past, such calculations have been confined to problems involving infinite slabs of transport materials. In the present report the transmission and reflection problem for spherical geometries is investigated both analytically and numerically. Several calculational algorithms have been devised, tested, and compared. Graphs, computer printouts, and the complete computer program are included. Author (TAB)

N70-32380# Columbia Univ., New York. Radiation Research Lab.
ANALYSIS OF PATTERNS OF ENERGY DEPOSITION
Albrecht M. Kellerer *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 107–135 refs (See N70-32378 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The microscopic patterns of energy deposition by ionizing radiation are described by Rossi's probability distributions of specific energy. Theoretical derivation and analysis of the microdosimetric functions is based on the concepts of probability theory. These concepts are outlined, some theoretical relations of practical import are listed, and existing computational techniques are referred to. Author

N70-32381# Hammersmith Hospital, London (England). Medical Physics Dept.

FURTHER MEASUREMENTS OF LET SPECTRA WITH A 10 cm SPHERICAL ROSSI COUNTER

K. S. J. Wilson and S. B. Field *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 137–152 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

The LET spectra were determined for several fast neutron beams produced by the cyclotron at Hammersmith Hospital, for 14.6 MeV neutrons from the (d,t) generator at the Middlesex Hospital, and for scattered radiation at Nimrod, the 7 GeV proton synchrotron at the Rutherford High Energy Laboratory. In two cases comparisons are made with theoretical spectra, showing excellent agreement. The effect of 10 cm of paraffin wax on the (d,n) cyclotron neutrons is shown to be small. Author

N70-32397# Toulouse Univ. (France). Centre de Physique Atomique et Nucleaire.

SIMULATED TRANSPORT OF 2 MEV ELECTRONS IN VARIOUS SUBSTANCES [TRANSPORT SIMULE D'ELECTRONS DE 2 MEV DANS DIVERS MATERIAUX]

Jean-Paul Patau, Daniel Blanc, Jacques Mathieu, and Georges Mason *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 401–435 refs In FRENCH; ENGLISH summary (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

Electron travel through matter is simulated by means of energy dispersion and angular deflection distribution. The calculations give the energies deposited in depth, the slowing-down spectra, LET spectra and back-scattering factor of semi-infinite media and the transmission factors for thick foils. The materials dealt with beryllium, aluminium, Altuglass, and 2,2,4-trimethylpentane, are bombarded with a narrow beam of electrons with energies of up to 2 MeV. Author

N70-32398# Toulouse Univ. (France). Centre de Physique Atomique et Nucleaire.

MEASUREMENT OF DISTRIBUTION OF DOSE DEPOSITED IN DEPTH IN A PLEXIGLAS PHANTOM IRRADIATED WITH A BEAM OF 10, 15, 20 OR 30 MeV MONOENERGETIC ELECTRONS [MEASURE DE LA REPARTITION DE LA DOSE DEPOSEE EN PROFONDEUR DANS UN FANTOME DE PLEXIGLAS IRRADIE PAR UN FAISCEAU D'ELECTRONS MONOCINETIQUES DE 10, 15, 20 OU 30 MeV]

Jacques Mathieu, Daniel Blanc, Joseph Casanovas, Andree Dutreix (Inst. Gustave Roussy), Andre Wambersie (Cliniques Univ.) et al *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 437–453 refs In FRENCH; ENGLISH Summary (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

The ionization produced in depth in a plexiglas phantom irradiated by a monoenergetic electron beam was measured by means of an ionization chamber with a dielectric liquid. The sensitive volume is a thin film of liquid (0.9 mm thick), the electrodes are beryllium discs 0.5 mm thick, and the chamber walls are of plexiglas. The in-depth yield was measured at energies of 10, 15, 20 and 30 MeV and the results are compared with those obtained with a Baldwin chamber and with ferrous sulphate. Author

N70-32400# Gesellschaft fuer Strahlenforschung m.b.H., Frankfurt Am Main (West Germany). Abtlg. fuer Biophysikalische Strahlenforschung.

DETERMINATION OF THE ENERGY LOSS FOR AN INELASTIC COLLISION OF FAST ELECTRONS IN WATER

D. Frankenberg *In* EUROPEAN Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 479–492 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

Using the D(L 100 eV) spectra and the experimental G-values of G sub i(H), G sub i(OH), G sub i(H2), and G sub i(H2O2) in 0.8 N sulfuric acid for cobalt 60 gamma-, helium 3 beta-, and polonium 210 alpha-rays, the G-values G sub k(H), G sub k(OH), G sub k(H2), and G sub k(H2O2) were determined for three D(L100 ev) subranges R sub k(k = 1,2,3n). Using the G-values for the subrange R sub 1 the mean energy loss of an inelastic collision was calculated at 18.8 eV. Author

N70-32401# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.

THE VARIATION OF W WITH THE ENERGY OF HEAVY IONS

J. A. Dennis *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 493–510 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

W values for carbon and oxygen ions in carbon dioxide were calculated as a function of energy. The calculation is based on the scattering cross-sections of atoms for ions derived from the Thomas-Fermi atomic model. It is assumed that such scattering does not lead to ionization. The interaction of a heavy ion with electrons is assumed to result in a stopping power proportional to the ion velocity and to always lead to the same ionization efficiency. The calculation is taken to successively higher degrees of approximation corresponding to primary, secondary, tertiary, and higher atomic displacements. Owing to the rapid convergence, a fifth degree of approximation appears to be sufficient. A reasonable degree of agreement with experiment is observed. Author

N70-32402# Washington Univ., Seattle.

QUANTUM MECHANICAL BOUND STATE CORRECTIONS TO THE 1/E(2) COLLISION SPECTRUM

Hans Bichsel *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 511–528 refs (See N70-32376 17-04)

(Grant PHS CA-08150)

Avail: CFSTI HC$10.00/MF$0.65

In calculations concerning the interaction of heavy charged particles with atoms, it is assumed that the spectrum of energy losses of incident particles is described by a classical result, which is not an accurate representation of the spectra expected in experimental observations. A better approximation is obtained from calculations with the first Born approximation, using hydrogenic atomic wave functions. The results of such calculations are presented, several concepts of the number of collisions in a thin foil, energy loss, etc., are discussed, and corrections necessary in the classical formalism are shown. Author

N70-32404# National Bureau of Standards, Washington, D.C.

SPECTRUM OF ENERGY DEPOSITED BY ELECTRONS IN SPHERICAL REGIONS

Martin J. Berger *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 541–566 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

Exploratory Monte Carlo calculations of electron transport in water have been made which are pertinent to microdosimetry. The objective of these calculations was to determine energy deposition spectra in spherical regions, i.e., the statistical distribution of the amounts of energy deposited as the result of the passage of electrons. Calculations were made for electrons with ranges comparable in magnitude to the size of the regions traversed, and the treatment therefore had to include certain phenomena that have been disregarded in previous microdosimetry calculations. These phenomena included: (1) pathlength fluctuations and detours caused by multiple elastic scattering; (2) repeated passages of the same electron through the region as the result of backscattering;

(3) the transport of energy into and out of the region of secondary knock-on electrons; and (4) the contributions to the energy deposition spectra from electrons born inside the region. Numerical results are presented for electrons with an initial energy of 5 keV that deposit their energy in spherical regions with diameters of 0.2 and 1.0 microns. Author

N70-32405# Wuerzburg Univ. (West Germany). Physikalisches Inst.

SOME GENERAL RESULTS FROM THE TRANSPORT THEORY OF ELECTRON ABSORPTION

Dietrich Harder *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 567–594 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

From the general transport equation in continuous slowing down approximation and spherical harmonics expansion, using coordinates rescaled with reference to the mean pathlength it is shown that the energy dependence of the "scattering function" is decisive for the whole penetration phenomenon. Several experimental observations over a wide range of energies and atomic numbers are shown to be consistent with these derivations. The screening of the nuclear Coulomb potential is of importance at low electron energies, causing backscattering and detour factors to fall off during electron slowing down. The slowing down spectrum may be described by a simple fitted function as long as the secondary electron production is governed by the Moller cross section. Author

N70-32406# Wuerzburg Univ. (West Germany). Physikalisches Inst.

SECONDARY ELECTRON SPECTRUM BUILD-UP IN HIGH-ENERGY ELECTRON RADIATION [AUFBAU DES SEKUNDAERELEKTRONENSPEKTRUMS BEI ENERGIEREICHER ELEKTRONENSTRAHLUNG]

H. J. Schulz and D. Harder *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 595–613 refs In GERMAN; ENGLISH summary (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

Mathematical difficulties in the analytical treatment of the passage of electrons through layers of matter arise particularly when the electron deviations induced by the scatter process make an appreciable contribution to the energy loss or the decrease in the particle energy during the slowing-down process affects the scatter behavior. These difficulties also occur in the secondary electron spectra behind various thick build-up layers. It is demonstrated in this case how a numerical calculation, an important element of which is a Monte Carlo calculation, leads to the desired formulation. Final results and important intermediate steps in the calcualtion process are compared with available experimental data. From the calculation and the experiment, it is seen how the formulations made in the case of thick layers cease to apply as a result of scattering and slowing-down. The number of particles tends towards saturation with increasing layer thickness, and at a rate which is in inverse proportion to the value of the energy under consideration. Author

N70-32407# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Inst. fuer Strahlenschutz.

SPATIAL DISTRIBUTION OF DEPOSITED ENERGY ALONG THE PATH OF HEAVY CHARGED PARTICLES

H. Paretzke and G. Burger *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 615–630 refs (See N70-32367 17-04)

Avail: CFSTI HC$10.00/MF$0.65

The spatial distribution of energy deposition along the path of heavy energetic charged particles has been calculated. The results are presented with reference to a work, demonstrating the role of delta rays in the local spread-out of energy loss. The calculations are based on a semianalytical method. Several simplifications have to be accepted in this formalism. Some problems introduced herewith and the influence of possible variations on the results are discussed. The work was done in order to investigate criteria for the preferential etchability of ion tracks in polymers based on modified LET-concepts. Author

N70-32408# Nebraska Univ., Lincoln. Behlen Lab. of Physics.

PARTICLE TRACKS IN EMULSION

Robert Katz *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 631–652 refs Sponsored by AEC and NSF (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

Both the response of nuclear emulsion to electron beams and the structure of the tracks of charged particles are well described by a theory which assumes that the dose-response curve is one of exponential survival, or "1-hit to dose". Calculated blackness-fluence curves are in good agreement with experimental data obtained with G.5 and K.2 emulsions bombarded with normally incident electron beams at incident energies between 7 and 60 keV. Calculations of the microdose distribution surrounding a particle track make it possible to calculate the structure of particle tracks from the same dose-effect relationship, attributing the observed effect to the energy deposited by delta rays. The construction of the theory is identical with earlier work on the theory of RBE and of NaI(Tl). Author

N70-32409# Brookhaven National Lab., Upton, N.Y. Health Physics Div.

COMPARISON OF DISTANCE AND ENERGY-RESTRICTED LINEAR ENERGY TRANSFER FOR HEAVY PARTICLES WITH 0.25 TO 1000 MEV/amu

J. W. Baum *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 653–666 refs (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

While linear energy transfer (LET) has been a very useful concept in radiobiology, its limitations have often been noted. Frequently, correlation with radiobiological data has been improved by considering total LET in terms of a track-core fraction and a delta-ray fraction. A new and simple method for calculating restricted track radius is presented. Classical collision theory is used to predict energy, angle and number of secondary electrons. Cole's recent range-energy data are employed to determine energy deposition by electrons as they leave the track core. Largest differences are found for low energy particles and small track radii. Differences vary from factors of 1.5 to 5, depending on the assumptions one makes about the energy (average energy of ionization and excitation, I) contained in the atoms which experience the primary interactions. It is suggested that restricted track radius is generally a better parameter than restricted delta-ray energy for use in radiation damage studies such as those of interest in radiobiology. Author

N70-32412# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany). Abteilung Strahlenphysik.

MICRODOSIMETRIC CONCLUSIONS FROM CONDUCTIVITY MEASUREMENTS IN GAMMA-IRRADIATED DIELECTRIC LIQUIDS [MIKRODOSIMETRISCHE FOLGERUNGEN AUS LEITFAEHIGKEITSMESSUNGEN IN GAMMA-BESTRAHLTEN DIELEKTRISCHEN FLUESSIGKEITEN]

W. Jacobi and J. Hacke *In* EURATOM Proc. of the 2nd Symp. on Microdosimetry Jan. 1970 p 715–736 refs In GERMAN; ENGLISH summary (See N70-32376 17-04)

Avail: CFSTI HC$10.00/MF$0.65

The variation of conductivity in gamma-irradiated dielectric liquids is accounted for by the theory concerning preferential ion recombination in compressed gases. With reference to n-hexane it is shown that from the dependence of conductivity on field strength and temperature, quantitative information on the ion yield, the mean energy consumption per ion pair, the probability of initial recombination and the spatial distribution of the ions in the zone of the path of ionizing particles of low energy LET can be obtained. Lastly, the results with various liquids are summarized and discussed and the validity of the theory is demonstrated. Author

N70-32419# Columbia Univ., New York. Radiological Research Lab.
SUMMARY OF QUANTITIES AND FUNCTIONS EMPLOYED IN MICRODOSIMETRY
A. M. Kellerer and H. H. Rossi *In* EURATOM Proc. of the 2d Symp. on Microdosimetry Jan. 1970 p 843–853 ref (See N70-32376 17-04)
Avail: CFSTI HC$10.00/MF$0.65

The following is a summary of the quantities and units employed in microdosimetry and of various probability distributions, averages, etc., which are of direct interest either in the analysis of radiobiological data or in the derivation of one distribution, average, etc., from another. It is practical to use both probability densities, commonly called differential distributions, and their integrals, commonly called sum distributions. There is a high degree of symmetry between the variables linear energy transfer, linear energy density, and specific energy. Most of the relations between the associated probability distributions and their averages are of the same form for these variables. They are therefore not repeated in each separate section, but given in a form which is valid for all the distributions used. Author

N70-32469*# AC Electronics-Defense Research Labs., Santa Barbara, Calif.
CROSS SECTIONS FOR IONIZATION IN COLLISIONS BETWEEN EXCITED NITROGEN MOLECULES AND CARBON MONOXIDE AND NITROGEN GROUND-STATE MOLECULES
Nyle G. Utterback and Bert Van Zyl Jun. 1970 44 p refs
(Contract NAS2-5680)
(NASA-CR-73463; AC-DRL-TR70-55) Avail: CFSTI CSCL 18H

Research was initiated to validate a previously proposed model for bulk ionization. The model directly employs kinetic theory in terms of cross sections for ionization, and the reaction rate is determined by straight-forward integration over all ionizing collisions. The important feature is that collisions between internally excited collision partners are not ignored, as they were previously. In validating the model, measurements were made for collisions between excited partners. The experimentation is described and the resulting cross section measurements are presented. D.L.G.

N70-32476 National Lending Library for Science and Technology, Boston Spa (England).
ON THE QUANTUM THEORY OF RADIATION
A. Einstein 28 Nov. 1969 15 p ref Transl. into ENGLISH from Physik. Z., v. 18, 1917 p 121–128
(NLL-M-7964-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The fundamental relation between the chromatic distribution curve of thermal radiation and the Maxwell law of velocity distribution is investigated. The distribution of the internal energy states of the molecules required by the quantum theory is considered to arise only through absorption and emission of radiation. It is proved that the hypotheses provide not only the appropriate statistical distribution of internal energy but also a momentum transfer to or from the molecules when radiation is absorbed or emitted. It is felt that the result concerning the momentum transfer is the most important. N.E.N.

N70-32478# Naval Ordnance Lab., White Oak, Md.
GAMMA SPECTRA DATA PROCESSING PROGRAMS
Gordon K. Riel, Susan W. Madigosky, and Donald G. Simons 11 Dec. 1969 73 p refs
(Contract AT(49-7)-2430)
(AD-704786; NOLTR-69-233) Avail: CFSTI CSCL 18/2

The FORTRAN IV programs for processing spectra (number of events per energy interval histograms) include: GAMMA, which normalizes the zero intercept and energy per interval; SPEC, which determines quantitatively the radioisotopes in the spectra by sequential subtraction of standard spectra; MONTE CARLO, which produces standard spectra for a given detector and incident energy; and MERGE, which combines standard spectra of various energies to duplicate the spectrum of a radioisotope. GAMMA, MERGE, and SPEC will work for any consistent set of histograms, while MONTE CARLO contains parameters for a sodium iodide (thallium) gamma-ray detector in an infinite medium containing a uniformly distributed source. The programs are used to analyze the concentration of radioisotopes in water. Author (TAB)

N70-32523*# Oak Ridge National Lab., Tenn.
ABSORPTION, CHARGE-EXCHANGE, AND DOUBLE-CHARGE-EXCHANGE REACTIONS OF PIONS WITH COMPLEX NUCLEI: COMPARISON OF THEORETICAL PREDICTIONS WITH EXPERIMENTAL RESULTS
Hugo W. Bertini 14 Jul. 1969 35 p refs Submitted for publication Sponsored in part by AEC
(NASA Order H-382804-A)
(NASA-CR-110719; ORNL-TM-2699) Avail: CFSTI CSCL 20H

The two step intranuclear-cascade evaporation model is used in the calculation of nucleon spectra, particle multiplicities, and radiochemical cross sections following stopped negative pi meson absorptions by complex nuclei. Author (USGRDR)

N70-32584 European Organization for Nuclear Research, Geneva (Switzerland).
STUDY OF THE DEPOLARIZATION OF A GROUP OF PROTONS ACCELERATED IN A SYNCHROCYLOTRON. CALCULATIONS APPLIED TO THE CERN SC [ETUDE DE LA DEPOLARISATION D'UN FAISCEAU DE PROTONS ACCELERE DANS UN SYNCHROCYCLOTRON. APPLICATION DES CALCULS AU SC DU CERN]
Gilbert Besnier (Ph.D. Thesis—Rennes Univ.) 1970 54 p refs In FRENCH
(CERN-70-11) Copyright. Avail: Issuing Activity

The acceleration of a group of polarized protons at high energies to determine the nuclear forces dependent on spin was considered. The classic equations of relative spin were used in calculation procedures. Resonance zones and perturbation amplitudes dependent on acceleration were also considered. The magnetic perturbation was studied considering the resonance within the structure of the focal field. The structure of the perturbed field was shown by the nonresonating horizontal circular harmonics. Transl. by J.M.C.

N70-32606# California Univ., Livermore. Lawrence Radiation Lab.
COMPILATION OF X-RAY CROSS SECTIONS, SECTION 4
W. H. Mc Master, N. Kerr del Grande, J. H. Mallett, and J. H. Hubbell Aug. 1969 40 p Sponsored by AEC
(UCRL-50174-Sect-4) Avail: CFSTI

This section contains tables of cross section values evaluated at the energies most used by X-ray crystallographers, ranging from 1.7444 to 9.5720 keV. The cross sections are expressed in barns/atom and sq cm g for Z = 1 through 94. NSA

N70-32608# Los Alamos Scientific Lab., N.Mex.
PROCEEDINGS OF THE THIRD LAMPF USERS MEETING
Lewis Agnew and Billie F. Miller, comps. 17 Mar. 1970 53 p

refs Conf. held at Boulder, Colo., 29 Oct. 1969
(Contract W-7405-eng-36)
(LA-4397) Avail: CFSTI

Reports presented include LAMPF status report, the nucleon-nucleon problem at LAMPF, and potentialities of negative pion meson beams in radiotherapy of cancer. Other topics briefly discussed include pion biomedical problems, stopped muon channel, nucleon physics, pion and particle physics, and the energetic pion channel and spectrometer. NSA

N70-32609# Syracuse Univ., N.Y. Dept. of Physics.
SOLUTION OF MULTI-ATOM RADIATION MODEL USING BARGMAN REALIZATION OF THE RADIATION FIELD
William R. Mallory Jul. 1969 43 p refs Sponsored by AEC
(NYO-3399-201; SU-1206-201) Avail: CFSTI

A model for interacting single-mode electromagnetic radiation and matter consisting of N two-level particles is solved exactly, using a representation in which the creation and destruction operators for the field act by multiplication and differentiation, respectively. The model includes off-resonant interactions. Closed-form expressions can be given for some special cases. The solutions are transformed to the more familiar Fock and Schroedinger representations. Numerical results are given to indicate the behavior of the solutions. An equation for a generating function is derived that would give solutions of the (algebraic) matrix equation to which the problem has been reduced. Author (NSA)

N70-32732# Karlsruhe Univ. (West Germany). Inst. fuer Struktur der Materie.
DP1: AN ALGOL PROGRAM FOR THE COMPUTATION OF ENERGY SPECTRA OF SCATTERED GAMMA RAYS IN A FINITE SLAB SHIELD
S. A. W. Gerstl Dec. 1969 36 p refs In GERMAN
(BMBW-FBK-69-43) Avail: AEC Depository Libraries

The ALGOL-program DP1 solves the equations of the double P sub 1- approximation for the transport equation, which depends on space, angle and energy, in slab geometry for gamma-rays. This report gives a summarized description of the formalism of the solutions and finishes with the listing of the complete ALGOL-program. The main aim of the report is the specification of input and output data. A detailed discussion is devoted to the numerical integration, which uses a generalized Simpson rule with nonequal integration steps for integrands with two discontinuities. The approach used, permits the explicit analytical formulation of the final result and could also serve as a first step towards a generalization to higher DP sub L-approximations. Author (NSA)

N70-32734# Atomic Energy Commission, New York. Health and Safety Lab.
SHIELDING CALCULATIONS FOR BROAD NEUTRON BEAMS NORMALLY INCIDENT ON SLABS OF CONCRETE
Keran O'Brien Jan. 1970 10 p refs
(HASL-221) Avail: CFSTI

The validity of the P3 spherical harmonics method of calculating neutron transport was checked by comparison with results obtained using Monte Carlo and discrete ordinates methods. Neutron transport calculations were then carried out to obtain the neutron dose equivalent transmitted through slabs of concrete by normally incident beams of 50, 100, 150, 250, and 350 MeV. Author (NSA)

N70-32737# Sandia Corp., Albuquerque, N.Mex. Radiation Source Diagnostics Div.
ELECTRON BEAM DIAGNOSTICS, PART 1
William H. Buckalew and Lawrence D. Posey Oct. 1969 118 p refs
(SC-RR-69-512) Avail: CFSTI

Methods for performing pulsed electron beam diagnostics are presented, and techniques for determining energy deposition profiles and beam energy density are discussed. The dosimetry materials and instrumentation employed in measurements of this type are treated in detail. In addition, techniques for the determination of electron beam pulse profile as well as differential energy spectrum are considered. Author (NSA)

N70-32743# Brookhaven National Lab., Upton, N.Y.
PHONON SPECTRA, IMPURITIES AND SUPERCONDUCTING TRANSITION TEMPERATURES
Brenda Choyce 18 Mar. 1970 37 p refs Sponsored in part by AEC and NSF
(BNL-14524; PD-105) Avail: CFSTI

The superconducting transition temperature is affected by the introduction of impurities into the material of a particular case of strong-coupling superconductors and is dependent only on the lattice dynamics of the metal. Assuming that McMillan's observation is generally correct, the effect of isolated impurities on the transition temperature can be calculated from their effects on the parameter. The reduced parameter is calcualted for different models of the phonon density of states and for the phonon density of states of niobium determined from inelastic neutron scattering. This was done by using Elliott's exact solution of the lattice dynamics of a substitutional impurity with only a mass discrepancy (no change in the binding forces is considered). The results of these calculations indicate that the reduced parameter is dependent linearly on the logarithm of R, the ratio of the mass impurity to the atomic lattice mass, for most reasonable models. Author (NSA)

N70-32755# Naval Postgraduate School, Monterey, Calif. Dept. of Physics.
ENERGY LOSS OF HIGH ENERGY ELECTRONS IN ALUMINUM, COPPER, AND LEAD
Wood Rene De Leuil (M.S. Thesis) (Army) and James Bruce Raynis (M.S. Thesis) (Army) Jun. 1969 52 p refs
(AD-705062) Avail: CFSTI CSCL 7/4

The energy distributions of electrons of about 54, 75, and 92 MeV were measured before and after passing through lead absorbers of thicknesses ranging from 0.706 to 2.825 gm/sq. cm., and through copper and aluminum absorbers up to 5.726 gm/sq. cm. Author (TAB)

N70-32775# Michigan State Univ., East Lansing. Dept. of Physics.
ON THE SOLUTION OF THE NUCLEAR THREE BODY PROBLEM IN COORDINATE SPACE
J. Borysowicz [1970] 10 p refs Sponsored in part by AEC
(COO-1051-41) Avail: CFSTI

A new method to find the wave functions and binding energy of the three-nucleon system is discussed. Results of the calculations with local, central potentials are given. The wave functions are found to be sensitive to the shape of the nucleon–nucleon potential. The corresponding binding energies differ by less than 0.6 MeV. Author (NSA)

N70-32786*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SYSTEMATIC METHOD OF CALCULATING REDUCED MATRIX ELEMENTS OF SINGLE-PARTICLE OPERATORS
William F. Ford and Richard C. Braley Washington Jul. 1970 34 p refs
(NASA-TN-D-5879; E-5366) Avail: CFSTI CSCL 18H

Many nuclear properties involve the evaluation of reduced matrix elements of single-particle operators between the initial and final nuclear states. A systematic means of calculating such matrix elements was developed in terms of inelastic transition densities, which essentially give the probability for absorption of angular

momentum J = L + S by the last nucleon as a function of its distance from the nuclear origin. These densities may be expanded in terms of Gauss-Laguerre functions, permitting substantial simplification in the matrix element calculation. Examples and useful formulas are presented. Author

N70-32788# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
SPIN DETERMINATION OF RESONANCES IN Ho 165 (n,gamma) FROM LOW LEVEL OCCUPATION PROBABILITY RATIOS
W. P. Poenitz (ANL) and J. R. Tatarczuk [1970] 22 p refs Sponsored by AEC
(RPI-328-186) Avail: CFSTI

The dependence of the low level occupation probabilities on the compound state spin has been used to assign spin values to fourteen resonances in the reaction Ho-165(n,gamma) Ho-166 within the neutron energy range from 18 to 86 eV. The low level occupation probabilities were determined from the intensities of gamma rays deexciting these levels. These intensities have been measured in a time-of-flight experiment at the Rensselaer electron linear accelerator using a Ge(Li) detector. The spins assigned in the present experiment agree with those of the seven resonances where spin values have been recommended in BNL 325. Author (NSA)

N70-32804# Oak Ridge National Lab., Tenn.
CROSS-SECTION AND NUCLEAR-CONSTANT DATA FOR HEAVY METAL NUCLIDES (FUELS)
Paul R. Kasten, C. W. Craven, Jr., and Richard Q. Wright Apr. 1970 21 p
(Contract W-7405-eng-26)
(ORNL-TM-2851-Rev) Avail: CFSTI

Cross sections and nuclear constants of fissile and fertile materials and of higher isotopes are summarized in graphical form, based on ENDF/B data. The resulting figures permit visual appreciation of nuclear data in present use, and relative comparison of data for the different fissile, fertile, and higher-isotope materials. Author (NSA)

N70-32807# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique
ATTEMPT TO EVALUATE RENORMALIZED RADIATIVE CORRECTIONS BY COMPUTER
J. Calmet and M. Perrottet [1968] 27 p refs
(CNRS-CPT-69-P-317) Avail: AEC Depository Libraries

An attempt is made to apply algebraic computational techniques to renormalization theory, by means of the programming language LISP. Programs that generate Feynman diagrams from the functional formalism for a scalar field as well as for quantum electrodynamics are described. Feynman integrals over the internal momenta are integrated with the g(psi 3) scalar model and divergences of this superrenormalizable theory are removed. The numerical evaluation over Feynman parameters is made. Author (NSA)

N70-32808# Yeshiva Univ., New York. Belfer Graduate School of Science.
[NUCLEAR PHYSICS AND NUCLEOSYNTHESIS] Annual Progress Report
[1970] 11 p refs
(Contract AT(30-1)-3962)
(NYO-3962-2) Avail: CFSTI

A brief summary is given on the work carried out in the areas of neutron-star matter, neutron-rich nuclei, the URCA process in white dwarfs, and the nuclear mass formula. NSA

N70-32830# Ceskoslovenska Akademie Ved., Rez.
MUTUAL TRANSFORMATIONS OF THE PARTICLES
M. Vymazal [1968] 10 p refs In CZECHOSLOVAKIAN; ENGLISH summary
(UJV-2312-F) Avail: AEC Depository Libraries

An attempt is made to formulate and solve the problem of the mutual transformations of the particles. Any notions like space and time are avoided, and a single self-interacting beginning called energy is assumed. Particle decays and scattering processes are considered. NSA

N70-32831# TRI-Univ. Meson Facility, Vancouver (British Columbia).
PHASE SPACE ACCEPTANCE OF A HELICAL QUADRUPOLE CHANNEL OF FINITE LENGTH
Shoroku Ohnuma Oct. 1969 35 p refs
(TRI-69-10) Avail: AEC Depository Libraries

The acceptance region in the four-dimensional phase space of a helical quadrupole channel has been investigated numerically. The two transverse directions are strongly coupled and the projection on the (x,x prime) plane of the four-dimensional acceptance region is not independent (y,y prime). If such a channel is used as a pion or a muon channel, it has to be matched to quadrupoles and bending magnets so that its effective acceptance would become smaller than the acceptance region in the four-dimensional phase space. In calculating the acceptance, a circular aperture has been assumed. Also, the axial magnetic field B sub z is assumed to be small so that the transverse equations of motion are linear. Author (NSA)

N70-32833# California Univ., La Jolla. Inst. for Pure and Applied Science.
REARRANGEMENT EFFECTS AND THE PARAMETRIZATION OF THE EFFECTIVE FIELD IN NUCLEI
H. Meldner and C. M. Shakin (MIT, Cambridge) [1969] 13 p refs Prepared in cooperation with MIT, Cambridge
(Contracts AT(11-1)-GEN-10; AT(30-1)-2098)
(UCSD-10-P-11-99) Avail: CFSTI

A simple parametrization of the non-local effective field in nuclei is provided. The parameters as determined by fitting the properties of nuclear matter are quite similar to those which have been shown to yield good results for the size and binding energies of finite nuclei throughout the periodic table. It is shown that the self-consistent single-particle energies are significantly different from the separation energies (rearrangement effect) and consequences for structure calculations and particle knock-out experiments are discussed. Author (NSA)

N70-32851# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
SPECTRA PROGRAM USER'S MANUAL
N. R. Baumgardt Dec. 1969 197 p refs
(Contract AT(40-1)-2847)
(GEMP-728) Avail: CFSTI

The SPECTRA Program uses Monte Carlo techniques to describe neutron collision sequences in a material under irradiation. The number of primary knock-on atoms resulting from these collisions and their energy spectra are computed. This report is a user's manual for the revised version of SPECTRA and the two related programs, 20-4 and the SPECTRA input program. All of these programs were written for the IBM 7090-94 computers. SPECTRA is written in FAP and the SPECTRA input program and 20-4 are written in FORTRAN 2. Author (NSA)

N70-32859# Sandia Corp., Albuquerque, N.Mex. Aerospace Nuclear Safety Dept.
ANNOUNCEMENT OF COMPUTER CODE HRB017: A CODE FOR THE COMPUTATION OF THE TRAJECTORY AND

REENTRY ENVIRONMENT FOR NUCLEAR SYSTEMS DECAYING FROM MULTIPLE REVOLUTION ELLIPTICAL ORBITS (SC-RR-69-378 AND SC-RR-70-143)
H. R. Spahr Jan. 1970 6 p refs
(SC-M-70-157) Avail: CFSTI

Computer code HRS017 calculates and prints in tabular form the trajectory and reentry environment for nuclear systems decaying from multiple revolution elliptical orbits, using a closed form approximate solution. The code also prepares a reentry environment punched card data deck for input to the Charring Materials Ablation code. Author (NSA)

N70-32949 Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
THE STATISTICAL ESTIMATION OF THE AVERAGE RESONANCE SPACING IN EVEN-A AND ODD-A NUCLEI
A. R. De L. Musgrove Sep. 1969 25 p refs
(AAEC/TM-515) Avail: AEC Depository Libraries

The statistical best estimate for the average level spacing (D) is calculated for even-A and odd-A target nuclei which form respectively one and two spin sequences when bombarded with s-wave neutrons. The expected error in the estimate is also given and is dependent on the spin of the target nucleus. Author (NSA)

N70-32955# Oak Ridge National Lab., Tenn.
COMPARISONS OF THE RESULTS OBTAINED WITH SEVERAL ELECTRON-PENETRATION CODES
W. Wayne Scott Mar. 1970 13 p refs Sponsored by AEC
(ORNL-RSIC-28) Avail: CFSTI

Comparisons of the results obtained for several similar hypothetical problems using electron-penetration codes available from the Radiation Shielding Information Center are presented. These codes are designed to determine the tissue surface dose as a function of shield thickness. Transmitted electron spectra from those codes which provide such spectra are also compared. Significant differences between the results given by the various codes are found. Author (NSA)

N70-32962# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
EXPERIENCE WITH LAGUERRE NUMERICAL INTEGRATION IN POINT KERNEL SHIELDING CALCULATIONS
D. W. Mesh and P. C. Cochrane Dec. 1969 11 p refs Presented at 17th Conf. on Remote Systems Technol., San Francisco
(Contract W-31-109-eng-52)
(KAPL-P-3848; CONF-691102-5) Avail: CFSTI

The equation for the radiation from a monoenergetic line source in a shield with a constant attenuation coefficient is given. An attempt is made to streamline numerical evaluation of the equation with a Gaussian–Laguerre integration procedure. The technique concentrates virtual source points (or quadrature points) where the integrand is largest, at the front of the source (i.e., nearest the detector). The accuracy of the Laguerre procedure is compared with the symmetric Gauss–Legendre method. NSA

N70-32963# California Univ., Berkeley. Lawrence Radiation Lab.
LONGITUDINAL INSTABILITIES IN CIRCULAR CHARGED BEAMS. PART 2: RADIATIVE INSTABILITY [PRODOL'NYYE NEUSTOYCHIVOSTI V KOL'TSEVYKH ZARYAZHENNYKH PUCHKAKH]
A. S. Bonch-Osmolovskii et al Nov. 1969 12 p refs Transl. into ENGLISH from Russian Report JINR-P9-4425, 1969 14 p in ENGLISH and RUSSIAN Sponsored by AEC
(UCRL-Trans-1403; JINR-P9-4425) Avail: CFSTI

The radiative instability in circular charged beams is discussed. Calculations of impedances in the resonance cases are presented for conditions of the beam near the wall and the beam at a large distance from the wall. Equations of state are developed. NSA

N70-32977# Lyon Univ. (France). Inst. de Physique Nucleaire.
USE OF RADIOACTIVE METHODS FOR THE DETERMINATION OF TRACES
J. Tousset 9 Dec. 1969 11 p refs In FRENCH Presented at Conf. on the Mod. Method of Analysis of Traces, Grenoble, France, 27 Nov. 1969
(LYCEN-6957; Conf-691118-1) Avail: AEC Depository Libraries

The various radioactive techniques used for the determination of traces are reviewed. They include methods based on nuclear reactions (activation analysis and detection analysis of the emitted particles) and methods using radioactive tracers (methods with isotopic tracers, methods with radioactive reagents, and radiometric titrations). The advantages and disadvantages of the methods are discussed. NSA

N70-32981# Research Inst. of National Defence, Stockholm (Sweden).
FUSION REACTION RATES AS DEPENDING ON THE PARTICLE DISTRIBUTION FUNCTIONS
H. I. Gustafsson Jul. 1969 25 p refs
(FOA-4-4392) Avail: AEC Depository Libraries

A few test functions assumed to represent steady-state isotropic particle distributions in the particle energy variable of the laboratory frame are constructed, discussed, and used for the averaging involved in the determination of reaction rates. The susceptibility of the rates to the forms of the distributions is examined. A numerical application is made for the D–T fusion reaction. The rates are compared to the Maxwellian rate, and discrepancies that may be experimentally significant are noted. Author (NSA)

N70-32982# Research Inst. of National Defence, Stockholm (Sweden).
METHODS FOR AUTORADIOGRAPHIC EXAMINATION OF SMALL RADIOACTIVE PARTICLES
J. Sisefsky Mar. 1970 64 p refs
(FOA-4-4417) Avail: AEC Depository Libraries

When a prepared sample of small radioactive particles is autoradiographed, the images are produced by radiation penetrating out from the particles into the surrounding emulsion, giving rise to circular spot images, the sizes of which depend on the intensity of the radiation. After exposure the emulsion is developed in such a way that the circular spots turn transparent and unstained against a translucent or transparently colored background. The active particles thus turn visible under the microscope and are identified by being situated in the very centers of the clear spots. Their activities can be measured from the sizes of these spots. How active particles, collected on filters, are prepared on transparent supports is described, and how this preparation is coated with emulsion, exposed, and processed is discussed. The spot size versus activity is discussed from theoretical and practical viewpoints (also for conventionally developed autoradiograms). Various sources of error are discussed, especially the case when the particles are so large compared with the spots that they cannot be considered as point sources. Author (NSA)

N70-32989# Illinois Univ., Urbana. Dept. of Physics.
THE NEUTRAL KAON PROTON POSITIVE PION CHANNEL IN POSITIVE KAON PROTON INTERACTIONS AT 3.2 GeV/c
Warren Eugene Shufeldt (Ph.D. Thesis) Feb. 1970 72 p refs
(Contract AT(11-1)-1195)
(COO-1195-178) Avail: CFSTI

The reaction positive kaon proton yields neutral kaon proton positive pion was studied with a 3 eV/microbarn exposure in the

ANL 30-inch hdyrogen bubble chamber. The 5700 two-prong V(0) events in this film sample were measured on SMP's and processed with the Illinois programs SPACE-ILLFIT-GNUS. The reaction is found to be dominated by production of the quasi-two body final states K(*) and K(0)N*. The absorptive peripheral model has been compared to the K(*) production data and although the spin density matrix elements show general agreement with its predictions, the differential cross section does not. The N(*) production data are well described by the rho and A sub 2 Regge pole modal of Krammer and Maor. The dependence of momentum transfer distributions upon invariant masses is also discussed.
Author (NSA)

N70-32991# Florida State Univ., Tallahassee.
RADIATION INDUCED LUMINESCENT PROCESSES IN GASES Progress Report
J. A. Llewellyn 1 Dec. 1969 112 p refs Supported by AEC
(ORO-3349-7) Avail: CFSTI

Studies of luminescence as a means of establishing the sequences and relative probabilities of the events that result in the transfer of energy from an energetic particle to a gaseous substrate are described. The radiative excited states produced in N2 under bombardment were surveyed in the emission range from 500 to 5000A. Some eight molecular systems and ten atomic systems were identified and relative intensities and pressure-dependent intensities were measured. In these experiments, the spatial distribution of luminescence induced by an electron beam is related first to effects of the primary beam and these are separated from those due to subsequent electron-induced, collision, and other energy transfer processes. The role of primary versus secondary processes was assessed, in part, based on measurements of the dependence of electron impact luminescent cross sections on the energy of the impacting electron. The slowing down of energetic electrons in He was also examined theoretically.
Author (NSA)

N70-32992# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
QUASI-PARTICLE STATES OF SPHERICAL NUCLEI
I. D. Khristov 1970 15 p refs In RUSSIAN
(JINR-P4-4898) Avail: AEC Depository Libraries

The role of the pair correlations of the superconducting type in spherical nuclei is studied. Within the framework of the superfluid model the equations are derived for the superfluidity and the energy of excited quasi-particle states taking into account the blocking. The energies and superfluid characteristics of quasi-particle states in the region of mass numbers $100 < A < 150$ are calculated. The blocking effect in spherical nuclei is estimated.
Author (NSA)

N70-32993# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LECTURES ON SCATTERING THEORY. 3
A. G. Sitenko 1969 49 p refs In RUSSIAN
(ITF-69-78) Avail: AEC Depository Libraries

Lectures on the additional questions of quantum mechanics are continued. The bases of non-relativistic theory of potential scattering are presented. Analytical properties of scattering matrix are considered in the given issue.
Author (NSA)

N70-32994# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LECTURES ON SCATTERING THEORY. 2
A. G. Sitenko 1969 35 p refs In RUSSIAN
(ITF-69-77) Avail: AEC Depository Libraries

Lectures on the additional questions of quantum mechanics are continued. The bases of non-relativistic theory of potential scattering are presented. The following questions are considered in the given issue: the particle wave function in external field, optical theorem, time inversion and reciprocity theorem.
Author (NSA)

N70-32995# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Leningrad (USSR).
TURBULENT HEATING OF IONS IN SKINNED HIGH FREQUENCY DISCHARGE
L. V. Dubovoi, B. A. Ivanov, and V. I. Chernobrovin 1969 24 p refs In RUSSIAN
(NP-18187) Avail: AEC Depository Libraries

A corpuscular diagnostics method was used for measuring energy spectra of ions in a strong hf discharge with skin current. The spectra revealed the presence of two groups of ions, the basic one with temperature of approximately 50 eV, and a small group with T approximately 700 eV, at mean electron temperature in the plasma of approximately 100 eV. Both groups of ions are described by a Maxwell energy distribution function. Data obtained indicate that the flow of the plasma initial discharge stage is collision-free, but the heating process of electrons and ions is turbulent. Results are in good agreement with the theory predicting plasma heating produced by the excitation in the skin-layer region of the ion-acoustic microinstability.
Author (NSA)

N70-32998# Franklin Inst., Swarthmore, Pa. Bartol Research Foundation.
STUDIES OF ELECTROMAGNETIC PROPERTIES OF EXCITED STATES OF NUCLEI Annual Progress Report, 1969
F. R. Metzger 12 Dec. 1969 60 p refs
(Contract AT(30-1)-3525)
(NYO-3525-48) Avail: CFSTI

The resonance fluorescence technique, utilizing electron bremsstrahlung as the source of the exciting gamma radiation and lithium-drifted germanium diodes as detectors, was applied to nuclear levels in Mn-55, Zn-64, Zn-66, Nd-144, Pb-206, and Bi-209. The slowing down of Sm-152 recoils with a few eV energy was studied via the observation of the shapes of the gamma emission lines, using the resonant scattering in the high speed rotor facility as the means of scanning these lines. Coulomb explosion of Fe(59)I2 molecules following beta decay was observed, and it was found that the probability for process is approximately an order of magnitude smaller than it is following electron capture. The emphasis of the theoretical program was to obtain a consistent description of the calcium isotopes, based on the interplay between shell-model and core-excited configurations. The analysis served to clarify the nature of many of the low lying $T = 0(+)$ states in these isotopes, which previously were not completely understood.
Author

N70-33001# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LECTURES ON SCATTERING THEORY. 4
A. G. Sitenko 1969 52 p refs In RUSSIAN
(ITF-69-79) Avail: AEC Depository Libraries

Lectures on the additional questions of quantum mechanics are continued. The bases of non-relativistic theory of potential scattering are considered in the lectures. The following questions are considered in the given issue: dispersional relations, complex moments, and separable representation and scattering amplitude.
Author (NSA)

N70-33009# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
ANALYTICAL CONSIDERATIONS OF THE PROTON BEAM EXTRACTION FROM THE DUBNA SYNCHROPHASOTRON BY EXCITING THE RESONANCE OR =2/3
M. Conte 1970 26 p refs
(JINR-E9-4925) Avail: AEC Depository Libraries

The conditions are considered of the excitation of the radial betatron oscillation resonance Q sub R = 2/3 for the proton beam extraction from the JINR synchrophasotron. The requirements for the system of the resonance excitation are formulated, the parameters of the necessary perturbations are presented.
Author (NSA)

N70-33010# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
THE EFFECT OF THE ELECTRO-MAGNETIC STRUCTURE OF HADRONS ON THE VALUE OF THE PION(−) PROTON YIELDS NEUTRON ELECTRON(+) ELECTRON(-) CROSS SECTION
A. V. Tarasov and L. G. Tkachev 1970 18 p refs In RUSSIAN
(JINR-P2-4970) Avail: AEC Depository Libraries

Differential cross section for the process pion(-) proton yields neutron electron(+) electron(-) near the 33-resonance is considered. It is shown that this cross section is especially sensitive to the value of the electronic proton radius. Author (NSA)

N70-33011# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ON THE PROCESSES WITH K-MESON DOUBLE STRANGE EXCHANGE
L. I. Lapidus, A. V. Tarasov, and Ch. Tseren 1970 18 p refs In RUSSIAN
(JINR-P2-5028) Avail: AEC Depository Libraries

The process of double strangeness exchange interactions of kaons with nuclei is discussed. Possible kaon double strange exchange processes on deuterons are presented. The deviation of the cross section is considered on the Glauber approximation. Estimates are given for the double strangeness exchange cross sections on nucleons and on deuterons. NSA

N70-33012# Joint Inst. for Nuclear Research, Dubna (USSR).
ON THE PROBLEM OF THE ULTRA-RELATIVISTIC ELECTRON BUNCH RADIATION IN A CYLINDRICAL RESONATOR
A. B. Kuznetsov and S. B. Rubin 1970 11 p refs In RUSSIAN
(JINR-P9-4909) Avail: AEC Depository Libraries

The formula for the energy of the radiation, excited inside a closed cylindrical resonator by a relativistic electron bunch passing through the resonator, is analyzed. It is shown that, within the ultrarelativistic limit, the increase of the initial energy of the bunch does not lead to the increase of the radiation energy. Author (NSA)

N70-33013# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LECTURES ON SCATTERING THEORY, 1
A. G. Sitenko 1969 49 p refs In RUSSIAN
(ITF-69-76) Avail: AEC Depository Libraries

The bases of nonrelativistic theory of potential scattering are presented in the lectures. The presentation is based on the introduction of the scattering matrix idea. There is given the detailed consideration of the properties of scattering matrix and its analytic properties in particular. The lectures fill up the gap existing between the university course of quantum mechanics and modern original works on scattering theory and can be the introduction into the theory of nuclear reactions and theory of elementary particles. Author (NSA)

N70-33024# Kansas Univ., Lawrence. Dept. of Geology.
STUDY OF NATURAL RADIATION DAMAGE IN MINERALS BY ELECTRON SPIN RESONANCE AND THERMOLUMINESCENCE Technical Progress Report, 1 Mar. 1969–1 Mar. 1970
1 Mar. 1970 8 p
(Contract AT(11-1)-1057)
(COO-1057-52) Avail: CFSTI

The development of an electron spin resonance method for the estimation of the geologic age of natural rock and mineral samples is described. Samples of apatite from granite samples dated by the rubidium-strontium method are now available for calibration of the ESR method. ESR is also being used with thermoluminescence to aid in the evaluation of the effects of high pressure deformation of minerals. Thermoluminescence is being used as a technique for the recognition of strain in crystalline rock. New experiments have been directed toward the determination of the ability of various crystal lattices to store energy under identical conditions of temperature, particle flux, and particle energy. Research continues on the chemical effects of high-energy protons in solid targets and ESR techniques have been helpful in evaluating the results. NSA

N70-33029# Bettis Atomic Power Lab., Pittsburgh, Pa.
A COMPARISON OF THERMAL NEUTRON ACTIVATION MEASUREMENTS AND MONTE CARLO CALCULATIONS IN LIGHT-WATER-MODERATED URANIUM CELLS
J. J. Volpe, J. Hardy, Jr., and D. Klein Mar. 1970 38 p refs
(Contract AT(11-1)-GEN-14)
(WARD-TM-932) Avail: CFSTI

Thermal disadvantage factors and spectral indices have been measured in a variety of lattices. One series contained slightly enriched uranium rods in hexagonal geometry; another used natural uranium fuel in slab geometry. Both types employed water as the moderator. The detectors used were Dy-164, Lu-176, and Pu-239. Full energy range (0 to 10 MeV) Monte Carlo calculations with explicit cell geometry representations were performed using the RECAP program. In addition, thermal energy range (0 to 0.625 eV) calculations were obtained with the Monte Carlo program MARC as well as with the integral transport theory code THERMOS. The purpose of these investigations was to test the adequacy of the various water scattering kernel models – Nelkin, Koppel, and Haywood – for a broad range of thermal flux characteristics: from a soft moderator spectrum with a steep spatial gradient to a very hard spectrum which was relatively flat as a function of position. Conclusions are presented. Author (NSA)

N70-33034# Deutsches Elektronen-Synchroton, Hamburg (West Germany).
THE TOTAL PAIR PRODUCTION CROSS-SECTION IN HYDROGEN AND HELIUM, PART 1: THE INTEGRATION OF THE JOST, LUTTINGER, AND SLOTNICK FORMULA FOR SIGMA SUB T
T. M. Knasel Jan. 1970 10 p refs
(DESY-70/2) Avail: AEC Depository Libraries

The total pair production cross section is evaluated using the formula of Jost, Luttinger, and Slotnick, for the elements hydrogen and helium. The accuracy of the work is 0.1%. Author

N70-33046# California Univ., Berkeley. Lawrence Radiation Lab.
LONGITUDINAL INSTABILITIES IN CIRCULAR CHARGED BEAMS, PART 1: EFFECT OF NEGATIVE MASS
A. G. Bonch-Osmolovskii et al Nov. 1969 17 p refs Transl. into ENGLISH from Russian Rept. JINR-P9-4424
(UCRL-Trans-1402) Avail: CFSTI

The stability of an electron ring placed in an infinitely long, perfectly conducting circular tube was analyzed, finite conductivity and the associated resistive instabilities can also be taken into account in this method. NSA

N70-33048# Los Alamos Scientific Lab., N.Mex.
THE DE-EXCITATION OF EVEN-ODD NUCLEI NEAR THE MAGIC NUMBER N-82 AFTER THERMAL NEUTRON CAPTURE
L. V. Groshev et al Oct. 1969 13 p refs Transl. into ENGLISH from Russian Rept. IAE-1780
(LA-tr-69-29) Avail: CFSTI

With an external beam of thermal neutrons, the gamma-ray spectra of even-odd nuclei of barium and cerium were measured with the help of a single crystal Ge(Li) spectrometer. The spectra obtained together with the gamma-ray spectra of odd neodymium nuclei made it possible to discover certain regularities in the de-excitation of even-odd nuclei with neutron numbers N = 79, 81,

83, and 85, testifying to direct thermal neutron capture by even-odd nuclei in the neighborhood of the magic number N = 82.
Author (NSA)

N70-33051# Uppsala Univ. (Sweden). Inst. of Physics.
LIFETIMES OF THE 557.3 AND 559.2 KEV LEVELS IN IR 193
K. G. Vaalivaara, J. Kozyczkowski, and A. Marelius Oct. 1969 10 p refs
(UUIP-662) Avail: AEC Depository Libraries

The lifetimes of some excited states in Ir-193 were measured. The previous 558-keV level was now shown to be a close doublet. For this reason only upper limits for the lifetimes of the 557.3- and 559.2-keV levels were given resulting from a measurement of the combined decay. In this work an attempt was made to get more accurate values of the lifetimes of the two levels from a special measurement of the lifetime of the 557.3-keV level. A comparison between different investigations is made. The lifetimes of the 557.3, 559.2 keV doublet in Ir-193 were measured by the delayed coincidence technique. The results are: 557.3 keV level: T sub 1/2 = 34 + or - 8 ps, 559.2 keV level: T sub 1/2 < or = to 76 ps. Furthermore, the lifetimes of two other excited states were measured. The results are: 361.8 keV level: T sub 1/2 = 36 + or - 7 ps, 712.1 keV level: T sub 1/2 = 15 + or - 14 ps.
Author (NSA)

N70-33053# Argonne National Lab., Ill.
THORIUM-URANIUM-PLUTONIUM ALLOYS AS POTENTIAL FAST POWER-REACTOR FUELS. PART 2: PROPERTIES AND IRRADIATION BEHAVIOR OF THORIUM-URANIUM-PLUTONIUM ALLOYS
B. Blumenthal, J. E. Sanecki, D. E. Busch, and D. R. O'Boyle Oct. 1969 39 p refs
(Contract W-31-109-eng-38)
(ANL-7259) Avail: CFSTI

Thorium-uranium-plutonium alloys with 10 to 20% uranium and 10% plutonium were evaluated for potential usefulness as fast reactor fuels at typical fast reactor operating temperatures. Irradiation tests in CP-5 showed that 5.6 at. % burnup of heavy metal atoms (Th + U + Pu) did not appreciably affect the original microstructure of the fuel. Fuel swelling, measured after irradiation, was about 7.3% per atomic percent burnup, and 70% of the fission gas was released into the plenum. The alloys, which were prepared by arc-melting and tilt-pour casting from metals of commercial purity, could be hot rolled at 450 C in a glovebox with a nitrogen atmosphere without additional protection. The hardness compressive strength, density, coefficient of thermal expansion, and thermal conductivity were measured for each alloy, and appropriate functions are reported. The alloys were found to be compatible with vanadium-base cladding materials, but not with stainless steel. The alloys compared favorably with other metal fuels in thermal-cycling experiments.
Author (NSA)

N70-33062# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
REPORT FOR THE FISCAL YEAR, 1 JANUARY–31 DECEMBER 1967
31 Dec. 1967 239 p refs In SPANISH
(NP-18113) Avail: AEC Depository Libraries

The research and development projects and administrative programs of the C.N.E.A. are briefly summarized. Publications issued during the period are listed.
NSA

N70-33082# Oak Ridge National Lab., Tenn.
ELECTRON ENERGY LEVELS IN FREE ATOMS FROM Z = 1 TO Z = 60
Manfred O. Krause 7 Apr. 1970 13 p refs Sponsored by AEC
(ORNL-TM-2943) Avail: CFSTI

Values of electron energy levels in free atoms from Z = 1 to Z = 60 were obtained by converting the Bearden and Burr's values for bound atoms with the aid of C. H. Moore's values for optical levels and theoretical values by Mann and by Froese–Fischer. With a few exceptions present values are considered to be accurate within + or - 2 eV.
Author (NSA)

N70-33084# Argonne National Lab., Ill.
BORN EFFECTIVE CROSS SECTIONS OF ELECTRON EXCITATION OF ATOMS [BORNOVSKIE EFFEKTIVNYE SECHENIYA VOZBUZHDENIYA ATOMOV ELEKTRONAMI]
L. A. Vainshtein et al Mar. 1970 29 p Transl. into ENGLISH from J. Quant. Spectrosc. Radiative Transfer (London), v. 8, 1968 p 1491–1526 Sponsored by AEC
(ANL-Trans-816) Avail: CFSTI

A summary of formulae and tables is given to permit calculation of the rate of electronic excitation and de-excitation of atoms. The effective cross section and the parameter are calculated for transitions without change of atomic spin by Born's method, and for intercombination transitions by the Born–Ochkur method. Bates' and Damgaard's approximation to Coulomb's atomic wave function was used. The theoretical results were approximated by simple equations of two variables. The parameters were found by the least squares method and are tabulated as functions of the effective principal quantum numbers of the initial and final states for the transitions s–s, s–p, s–d, p–p, p–d.
Author (NSA)

N70-33085# California Univ., Berkeley. Lawrence Radiation Lab.
THE THERMAL NEUTRON FLUX PRODUCED IN A SPHERICAL AND A CUBICAL CAVITY BY SLOWING DOWN OF FAST NEUTRONS IN THE CAVITY WALLS, FOR WALLS OF WATER AND CONCRETE, AS A FUNCTION OF CAVITY SIZE, USING THE DISCRETE S SUB n METHOD
Chun Bin Lim (M.S. Thesis) Aug. 1969 87 p refs
(Contract W-7405-eng-48)
(UCRL-19345) Avail: CFSTI

The slow-neutron flux in a cavity in some moderating materials like water and concrete is presumed to be quite uniform throughout the cavity when a fast-neutron source (approximately 2.5 MeV) is located at the geometrical center point. This uniformity may be used to good advantage in some places, like in the calibration of slow-neutron detectors, for example. An attempt is made to see how flat it is in the actual case through computer calculations, and further, to figure out the relation between the slow-neutron flux level in the cavity and the inner cavity surface area of the spherical shell, using the discrete S sub n method, an approximate method to solve the neutron transport equation. In running these problems with ANISN code, the sixteen group, P0, cross-section data (up to P1 term in hydrogen) of 1/E weighting was used. Later, an attempt is made to get the approximate level of the slow-neutron flux in the case of a cubical cavity by replacing it with an equivalent spherical cavity.
Author (NSA)

N70-33110# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
PARTICLE HOLE CONDITION IN THE Ca ISOTOPES [TEILCHEN LOCH ZUSTAENDE IN DEN Ca ISOTOPEN]
R. Santo [1968] 33 p refs In GERMAN Presented at Profess. Comm. on Nucl. Phys., Bad Neuenahr, W. Germ, 1968
(MPIH-1968/5/5) Avail: AEC Depository Libraries

Various reactions on the even isotopes of Ca were studied in order to find and analyze transitions which are forbidden in the simple shell model and to obtain data on the type and magnitude of the deviations from the shell model. A distorted wave Born approximation analysis was performed and spectroscopic factors were extracted. The results of the stripping and pick-up experiments were reported. An extensive analysis of the results led to the interpretation of the states occurring as particle-hole states. The reactions are two nucleon transfer reactions, which have not been extensively studied. Preliminary results from such experiments for

the reactions are discussed and show the importance of accurate investigations of this reaction for better understanding of these nuclei. NSA

N70-33115# Lockheed Missiles and Space Co., Palo Alto, Calif.
SODIUM LINE LASER IN Na(+) RECOMBINATION WITH H(−)
A. M. Shukhtin et al [1970] 22 p refs Transl. into ENGLISH from Fiz. Gasovykh Lazerov (Leningrad), 1969 p 122–143
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A plasma was assumed for which the state of the electron gas was characterized by a given temperature and the state of its other components by a different temperature. Under certain conditions it is assumed that the population of the atomic energy levels and the degree of ionization in the plasma correspond to equilibrium or near-equilibrium values with a temperature equal to the electron temperature. A sodium line laser is proposed on the basis of the assumptions. R.B.

N70-33119# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MODIFICATION OF THE GLAUBER FORMULA FOR VIOLATION OF THE POMERANCHUK THEOREM
N. M. Queen (Birmingham Univ.) and G. Violini (Rome Univ.) 24 Mar. 1970 6 p refs Submitted for publication
(JINR-E2-5007) Avail: AEC Depository Libraries

It is pointed out that the usual form of the Glauber formula for total deuteron cross sections breaks down if the Pomeranchuk theorem is violated, and a simple modification of it is derived for this case. Assuming the validity of the Okun–Pomeranchuk theorem, under general conditions the Glauber correction reduces asymptotically to the total elastic cross section for scattering by nucleons.

N70-33124*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THREE-PARTICLE COLLISIONS IN A GAS OF HARD SPHERES
W. R. Hoegy and J. V. Sengers (Maryland Univ.) May 1970 48 p refs Submitted for publication
(NASA-TM-X-63973; X-621-70-185) Avail: CFSTI CSCL 20H

The triple collision integrals which determine the first density correction to the transport coefficients, are derived for a gas of hard spheres using the binary collision expansion. This expansion provides a convenient technique for classifying the contributions in terms of sequences of successive binary collisions between three molecules. Such sequences contain both interacting and noninteracting collisions. It is demonstrated that for three hard spheres all sequences terminate after four successive collisions independent of the interacting or noninteracting nature of the collisions. As a consequence the collision integrals are related to a limited number of sequences with three and four collisions only. It is shown that equivalent results are obtained from the surface integral form of the triple collision operator, derived earlier by Green and Sengers. Author

N70-33142# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ELASTIC SCATTERING OF FAST PROTONS BY LIGHT NUCLEI
V. I. Komarov, G. E. Kosarev, and O. V. Savchenko 1969 20 p refs
(JINR-P1-4876) Avail: AEC Depository Libraries

An experiment for detecting the elastic backward scattering of 665-MeV protons by lithium isotopes is described. Lithium isotope recoil nuclei knocked out from the target at an angle of 5.4 degrees to the proton beam direction were identified by the effective momentum, the time of flight on two bases, ionization energy losses in three scintillation counters, and the range. For the discrimination of a random time coincidence of the secondary beam particles their tracks were recorded by the isotropic discharge chamber with an image intensifier. Author

N70-33143# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ACCOUNT OF RADIATION CORRECTIONS FOR THE EIKONAL SCATTERING AMPLITUDE IN QUANTUM FIELD THEORY MODEL
B. M. Barbashov, S. P. Kuleshov, V. A. Matveev, and A. N. Sisakyan 13 Mar. 1970 7 p refs
(JINR-E2-4983) Avail: AEC Depository Libraries

The eikonal representation for the scattering amplitude taking into account the radiation corrections is obtained by means of the functional integration method. In the approximation used the summation of the radiation corrections leads to the appearance in the expression for the scattering amplitude of the multiplicative factor depending only on the momentum transfer. Author (NSA)

N70-33145# Paris Univ. (France). Linear Accelerator Lab.
TEST OF ORIGINAL GEOMETRY FOR SOLVING THE LARGE BUBBLE CHAMBER PROBLEMS [ESSAI DE GEOMETRIE ORIGINALE RESOLVANT LES PROBLEMES DES CHAMBRES A BULLES GEANTES]
C. Pascaud and D. Morellet Jan. 1970 115 p refs In FRENCH
(LAL-1227) Avail: AEC Depository Libraries

The uncertainties due to the physical effects are included a priori in the matrix of covariances directing the particle trajectory fits. Because of economy the problem of geometry is separated into two distinct operations. The two operations are very similar and differ only by the degrees of approximations used. The reconstruction of the QCP points is given, and the method of beta transfer matrices is described in detail. A simplified schematic is given for the calculation of 1/G and of the matrix of the weights accumulated on the QCP points. Problems connected with particles at rest are considered. The approximations necessary for the final fit are evaluated. NSA

N70-33146# Toulouse Univ. (France). Faculty of Sciences.
SELECTIVE DETECTION OF GASEOUS FISSION PRODUCTS [DETECTION SELECTIVE DES PRODUITS DE FISSION GAZEUX]
Andre Bouville (Ph.D. Thesis) 1970 7 p refs In FRENCH; ENGLISH summary
(NP-18194) Avail: AEC Depository Libraries

A selective detection method of fission gases having a radioactive decay chain is described. Two types of detectors are used: (1) a sodium/thallium spectrometer for low activities and (2) a germanium/lithium diode for higher activities. Detection is made selective by the proper choice of the working conditions of the installation and by the use of a gamma spectrometer. The disintegration levels of the measured daughter products are studied and the cumulative fission yield of the gases is calculated. Author

N70-33174# Kernforschungszentrum, Karlsruhe (West Germany).
NUCLEAR DATA WORK IN THE SOVIET UNION [KERNDATENARBEITEN INDER SOWJETUNION]
1969 49 p refs Transl. into GERMAN from Russian papers presented at IAEA Panel on Neutron Data Compilation, Upton, N.Y., 10–14 Feb. 1969 In GERMAN
(KFK-tr-293) Avail: AEC Depository Libraries

Nuclear data evaluation and transfer, and an information center are discussed. Bibliographic data acquisition and processing, computer programming for evaluating nuclear data are discussed. The function and structure of the Obninsk Information Center is outlined, and data exchange with other centers is described. The

methods and requirements for extensive and rapid computerized exchange of data on neutron experiments are reviewed, and present and future possibilities and problems and data retrieval and representations are indicated. N.E.N.

N70-33177# Roswell Park Memorial Inst., Buffalo, N.Y.
[ON RADIATION DAMAGE PROCESSES AT THE MOLECULAR LEVEL] Progress Report
Feb. 1970 4 p
(Contract AT(30-1)-3558)
(NYO-3558-21) Avail: CFSTI

Electron-nuclear double resonance (ENDOR) studies were made on free radicals formed in irradiated ice. It was found that OH radicals are produced in 3 distinct environments. The creation of radical pairs from uv dissociation of molecules was studied. ENDOR spectroscopy was used to further document the structure of negative ions formed in carbosylic acids by ionizing radiation. Effects due to ionization and molecular excitation were studied in irradiated dibenzoyl disulfide. NSA

N70-33183*# Scientific Translation Service, Santa Barbara, Calif.
ON THE THEORY OF IONIZATION LOSSES OF FAST ELECTRONS [K TEORII IONIZATSIONNYKH POTER BYSTRYKH ELEKTRONOV]
A. S. Dolgov et al Washington NASA May 1970 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 9, 1969 p 153-155
(Contract NASw-2035)
(NASA-TT-F-12979) Avail: CFSTI CSCL 20H

The problem of energy losses of fast electrons with allowance for dependence of the energy transfer cross section on the energy loss magnitude is solved. The experimental results found previously are in qualitative agreement with those of this study. Author

N70-33188# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
PHENOMENOLOGIC INTERACTION LAGRANGIAN OF GOLDSTONE PARTICLES
D. V. Volkov 14 Oct. 1969 51 p refs In RUSSIAN; ENGLISH summary Presented at 3d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1969
(ITF-69-75) Avail: AEC Depository Libraries

The general scheme of the construction of phenomenologic Lagrangians for the arbitrary dynamic group theory is under consideration. Author (NSA)

N70-33190# Paris Univ. (France). Linear Accelerator Lab.
RECOIL PROTONS FROM WIDE ANGLE BREMSSTRAHLUNG
E. A. Allton and E. F. Erickson May 1969 28 p refs
(LAL-1196) Avail: AEC Depository Libraries

The momentum spectrum of the recoil protons produced in a liquid hydrogen target by an electron beam is studied. The contribution of wide-angle bremsstrahlung is considered and the differential cross section for this process is obtained by integrating the Bethe-Heitler terms of the BL matrix element over the phase space of the unobserved (final electron, photon) system. When the electron rest mass is neglected, the formula obtained is the sum of two terms, the dominant one being of logarithmic order. It is then similar to that obtained for the process in which the incoming electron radiates a photon backward in a physical radiator and then scatters elastically on a proton, which, in turn, recoils into the detector. Author (NSA)

N70-33192# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
PROTON LINEAR ACCELERATOR Final Progress Report, 1969
C. J. Batty, ed. Dec. 1969 148 p refs
(RHEL/R-187) Avail: AEC Depository Libraries; HMSO 1£; BIS 53.60

A survey is presented of the work of the Proton Linear Accelerator Group at the Rutherford Laboratory during 1969, the final year of operation of the machine, which was shut down on Oct. 3rd, 1969. Details are given of machine operation, proton scattering experiments, studies on proton induced reactions, theoretical studies on particle physics, experimental techniques, and health physics considerations. A list of publications by the staff is included. NSA

N70-33195# Lund Univ. (Sweden). Dept. of Physics.
HIGH ENERGY PHOTOFISSION IN U 238, Th 232, AND Bi 209
B. Schroeder, G. Nydahl, and B. Forkman Jul. 1969 29 p refs
(LUNP-6903) Avail: AEC Depository Libraries

The mass-yield distributions from photofission of U-238 and Th-232 at 300 to 1100 MeV and of Bi-209 at 700 MeV were measured using catcher-foil techniques combined with gamma-ray spectroscopy. The cross sections of symmetric and asymmetric photofission in uranium and thorium were calculated from the peak-to-valley ratios. The aim of the investigation was to improve an experimental method, combining catcher-foil techniques with gamma-ray spectroscopy, thus making it possible to measure the whole mass-yield distribution in one exposure for specific energy and target, to investigate the mass-yield distributions of uranium and thorium at 300, 500, 700, 900, and 1100 MeV and bismuth at 700 MeV, to estimate the symmetric mass distribution, to derive some information about the high-energy charge dispersion and Z sub p values, and to estimate the cross sections of symmetric and asymmetric photofission in uranium and thorium. Author (NSA)

N70-33197# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
EVALUATION OF THE DEUTERON QUADRUPOLE MOMENT BY NEUTRON PROTON AND PROTON PROTON SCATTERING
O. Ya. Savchenko 1969 32 p refs In RUSSIAN
(ITF-69-92) Avail: AEC Depository Libraries

Potential scattering of slow Dirac particles is considered in the presence of the S-level (an analog of the Wigner scattering of spinless particles). The analysis of scattering is carried out according to Zauter. To determine the observed quantities the method of introducing quantities by the hypercomplex dividers is used. The obtained results are used to estimate the deuteron quadrupole moment according to the data of np-scattering and pp-scattering in the range of 20 to 200 MeV. Author (NSA)

N70-33198# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
N-N INTERACTION AND THE AVERAGE NUCLEAR FIELD
V. V. Babikov 1970 30 p refs In RUSSIAN
(JINR-P4-4897) Avail: AEC Depository Libraries

The main trends and the latest achievements in nuclear forces theory are reviewed. Potential models of interaction in the two nucleon system and in a heavy nucleus are considered. The role of the heavy mesons in creation of a selfconsistent nuclear potential is analyzed. Statistical theories of nuclear matter distribution in finite nuclei are discussed. Author (NSA)

N70-33200# Universidad Nacional Autonoma de Mexico. Villa Obregon. Facultad de Ciencias.
SOURCE OF HIGH-INTENSITY X-RAYS IN THE INSTITUTE OF PHYSICS OF UNAM
Miguel Angel Limon Marquez (Ph.D. Thesis) 1969 92 p refs In SPANISH

(NP-18176) Avail: AEC Depository Libraries

The interaction of electrons with matter and the continuous X-ray spectrum of the bremsstrahlung radiation are described. In a discussion of the interaction of X-rays with matter, the basic theory of the production of X-rays by bombarding thick gold targets with high energy electrons and their interaction with matter is summarized. The Van de Graaff accelerator X-ray source, and the characteristics of the X-rays from this source are described. The precautions necessary for the protection of the personnel associated with the Van de Graaff accelerator are discussed. Some calculations and experimental routines used with the accelerator are given. Author (NSA)

N70-33209# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

PRECISE MEASUREMENTS OF THE AVERAGE KINETIC ENERGY OF FRAGMENTS IN THE FISSION OF U-235 BY FAST NEUTRONS

N. N. Ajitanand (Bhabha Atomic Res. Centre) and J. W. Boldeman Feb. 1970 11 p refs

(AAEC/TM-526) Avail: AEC Depository Libraries

The average total kinetic energy of fragments in the fission of U-235 by neutrons of energies ranging from 200 to 900 keV was measured using two solid-state detectors to detect the fission fragments in coincidence. The average total kinetic energy of fragments is independent of the incident neutron energy and, within experimental error, does not show the reported discontinuity around 300 keV neutron energy. Author (NSA)

N70-33210# Universidad Nacional Autonoma de Mexico, Villa Obregon. Facultad de Ciencias.

STUDY OF THE THRESHOLD RIGIDITY OF COSMIC RADIATION IN A MAGNETOSOPHERE MODEL [ESTUDIO DE LA RIGIDEZ UMBRAL DE LA RADIACION COSMICA EN UNA MAGNETOSFERA MODELO]

Jaime Jimenez Guzman (Ph.D. Thesis) 1969 153 p refs In SPANISH

(NP-18174) Avail: AEC Depository Libraries

The general aspects of the movement of particles in magnetic fields and a broader definition of threshold rigidity are described. The concept of magnetically quiet times is introduced. The threshold rigidity is studied with models which do not take into account the external sources of the field. The external sources included in the magnetospheric model used for the calculation of the threshold rigidity are then studied. The Mead–Williams model used in the computer is introduced and the method used is described in detail. The method used is the simulation of trajectories with numerical integration base. The results obtained are evaluated. Author (NSA)

N70-33213# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

NONDESTRUCTIVE NEUTRON ACTIVATION ANALYSIS OF MINERAL MATERIALS, 1

M. Vobecky, Z. Randa, J. Benada, and J. Kuncir Jan. 1970 113 p refs

(UJV-2319-CH) Avail: AEC Depository Libraries

An attempt was made to survey systematically nondestructive methods using in-reactor neutron activation and semiconductor gamma spectrometry for analyses of mineral materials. Gamma spectra, measured by means of a spectrometer with a lithium-drifted germanium detector one or more hours after activation of the sample by neutrons, are summarized for 27 minerals and rock samples. Spectra are given for 43 elements whose radionuclides are most frequently identified in the gamma spectra of those mineral materials. Author (NSA)

N70-33214# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

PRODUCTION OF CARRIER FREE MN 52

J. Hruby, V. Knobloch, B. Mudrova, and K. Svoboda 1970 65 p refs In CZECHOSLOVAKIAN

(UJV-2299-CH) Avail: AEC Depository Libraries

Studies undertaken with the aim to find out optimal methods of Mn-52 production by irradiation in the U-120 cyclotron are described. The production reaction Cr-52(d,2n)Mn-52 is used. Different shapes of targets (rectangular, loop-shape, cylindrical) as well as different methods of chromium target layer preparation and pre-irradiation treatment were tried. The most suitable proved to be a cylindrical copper target electrolytically covered with a 0.35-mm layer of chromium annealed at 300 C in a vacuum for 8 hours. Such targets can be irradiated without detectable damage with a beam of deuterons up to 350 micron A. The thick-target yields are 70 to 99% of the physically attainable value. Some efforts were undertaken to find out the best way of dissolving the target. Separation of Mn-52 from individual side products (V-48, Cr-51) and the bulk amount of chromium in the irradiated target was studied. The most suitable proved to be manganese extraction with thenoyltrifluoroacetone (TTA) into ethyl acetate from an aqueous solution at pH = 7 to 9. NSA

N70-33244# Kernforschungszentrum, Karlsruhe (West Germany). Zyklotron-Lab.

MEASUREMENT OF THE INELASTIC SCATTERING OF 104 MeV ALPHA PARTICLES AND THEIR DESCRIPTION BY THE AUSTERN-BLAIR THEORY

J. Specht, H. Rebel, G. Schatz, G. W. Schweimer, G. Hauser et al (Heidelberg Univ.) May 1969 29 p refs In GERMAN

(KFK-967) Avail: AEC Depository Libraries

Angular distribution of inelastically scattered alpha particles of 104 MeV was measured on carbon-12, neon-20, and nickel-64. Findings could be explained according to the theory of Austern and Blair by the assumption of excitations to the fifth order. From the measured and reduced matrix elements and under the assumption of a collective motion of the target nucleus, length of deformation could be obtained up to the 8th order. Excitation of the C-12 nucleus could be interpreted as surface vibration; excitation of the Ne-20 nucleus could be explained as rotation of a barrel-like configuration. NSA

N70-33248# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.

CALCULATION OF THE HALF LIVES OF UNKNOWN ISOTOPES OF THE ACTINIDES

K. A. Keller and H. Munzel Nov. 1969 42 p refs In GERMAN

(KFK-1059) Avail: AEC Depository Libraries

For the prediction of partial half-lives for alpha-decay and electron capture, semiempirical relations were derived. By use of mean excitation energies of the daughter nuclides an improved accuracy could be obtained. The total half-lives of neutron deficient actinide isotopes, extended up to atomic number 108, were computed by means of these equations, taking into account the partial half-lives for spontaneous fission. Author (NSA)

N70-33250# Mound Lab., Miamisburg, Ohio.

FEASIBILITY STUDY FOR LARGE SCALE SEPARATION OF Po-210 FROM BISMUTH METAL BY MOLECULAR DISTILLATION

C. H. H. Chong and C. M. Love 15 Apr. 1970 13 p refs

(Contract AT(33-1)-GEN-53)

(MLM-1661) Avail: CFSTI

Development studies were conducted to prove the feasibility of distilling polonium from large amounts of irradiated bismuth on a routine production basis. A prototype vacuum distillation system

was fabricated for an anticipated 10- to 20-fold enrichment of polonium in one distillation. The experimental hardware also included a decanning system for removing bismuth from its aluminum jacket. Non-irradiated bismuth slugs were employed to determine the necessary parameters required for eventual operation. The mock runs indicated that the concept of molecular distillation for concentrating polonium and the systems developed were valid.
Author (NSA)

N70-33256 Paris Univ., Orsay (France). Faculte des Sciences.
METHOD OF MEASUREMENT OF POLARIZATION. APPLICATION TO THE ELASTIC SCATTERING OF PROTONS ON H 3 AND He 3 [METHODE DE MESURE DE POLARISATION. APPLICATION A LA MESURE DES POLARISATIONS DES PROTONS DIFFUSES ELASTIQUEMENT SUR LES NOYAUX D'HELIUM 3 ET DE TRITIUM]
Robert Frascaria (Ph.D. Thesis) 1970 51 p refs In FRENCH
(NP-18116) Copyright. Avail: Issuing Activity

Proton double-scattering experiments were performed with a nonpolarized proton beam from a synchrocyclotron. The first scattering on a carbon target takes place in the deflection magnet, in order that the protons scattered at an angle could be directed toward the center of the reaction chamber. Then the polarized beam passes through a pair of quadrupolar lenses and two electrically independent solenoids to eliminate wrong asymmetries before reaching the reaction chamber. Characteristic features of the polarized proton beam obtained are given and the polarization produced on a second scattering carbon target is studied. Then, this polarized proton beam was used to measure the polarization in the elastic scattering of protons by He-3 and H-3 gaseous targets for lab angles between 11 and 50 deg. Results are in relatively good agreement with the theoretical calculation for polarization in the impulse approximation. If a certain percentage of S prime wave is included in the calculation, there is a good agreement up to 2% of S prime.
Author (NSA)

N70-33257 Paris Univ., Orsay (France). Faculte des Sciences.
MEASUREMENT OF THE PHASE PHI SUB 00 IN RELATION TO THE AMPLITUDE OF DECAY OF NEUTRAL KAONS IN THE 2 PION(0) MODE [MESURE DE LA PHASE PHI SUB 00 DU RAPPORT DES AMPLITUDES DE DESINTEGRATION DU NEUTRAL KAONS DANS LE MODE 2 PION(0)]
J. Chollet (Ph.D. Thesis) Dec. 1969 131 p refs In FRENCH
(LAL-1226) Copyright. Avail: Issuing Activity

The phase of the amplitudes of neutral kaons in the 2 pion decay mode is investigated using a kaon beam in a block of copper. In this way K1 is produced coherently with the incident K2. These two mesons can decay in the same state, which produces an interference term in the production intensity of the 2 pion. This allows a measurement of the phase phi sub 00 to be made which was found to be 21 + or − 30 deg.
NSA

N70-33258# Israel Atomic Energy Commission, Tel Aviv.
HYBSHOV: A PROGRAM FOR SOLVING THE FEW-GROUP SPACE-TIME DEPENDENT DIFFUSION EQUATION WITH A HYBRID COMPUTER Preliminary Report
D. Sephier and S. Yiftah May 1969 176 p refs Sponsored by ASTEF
(IA-1191-Add) Avail: AEC Depository Libraries

A program for solving the space-time dependent diffusion equation with a hybrid computer has been set up for the E.A.I.-8900 hybrid system. The digital part of the program is written in FORTRAN IV, and the control and data transfer subroutines are in the machine language of the E.A.I.-8400 digital computer. The diffusion equation is solved for a slab reactor with 44 mesh points, 4 energy groups and 4 groups of delayed neutrons. The number of regions is 7. In each region different isotopic composition is assumed. The maximum number of isotopes for which the code can prepare mixtures is 10. This report describes the assumptions made in developing the equations, and the limitations and range of the present program. A detailed description of the code as well as the various options are presented.
Author (NSA)

N70-33259# Tokyo Univ. (Japan). Inst. for Nuclear Study.
POLARIZATION OF LAMBDA HYPERONS IN THE REACTION GAMMA PROTON YIELDS KAON(+) LAMBDA HYPERON
Shuji Orito (Ph.D. Thesis) 16 Jul. 1969 55 p refs
(INSJ-113) Avail: AEC Depository Libraries

The K(+) mesons were detected with a magnetic spectrometer and a velocity selection system. The polarization of the Lambda hyperons was determined by measuring the up-down asymmetry of the protons with respect to the production plane. Based on the present measurements and the existing data, an energy-dependent multipole analysis of the reaction was carried out at a mass range from 1610 MeV to 1870 MeV. The analysis strongly indicates a contribution of the resonance P sub 11 (yields 1700). Without this resonance, it is difficult to fit the observed angular and energy dependences of the Lambda-polarization.
Author (NSA)

N70-33282# Bordeaux Univ. (France). Centre d'Etudes Nucleaires
THE REACTION Li-6(Li-6, alpha) 2 alpha BETWEEN 4 MeV AND 24 MeV EVIDENCE FOR A QUASIMOLECULAR STATE Li-6 Li-6
B. Frois, L. Marquez, J. L. Quebert, J. N. Scheurer, J. P. Laugier (Centre d'Etudes de Bruyeres le Chatel, France) et al 1969 7 p refs Presented at the Intern. Conf. on Nucl. Reactions Induced by Heavy Ions, Heidelberg, 15 − 18 Jul. 1969
(CEA-CONF-1456; CONF-690707-2) Avail: AEC Depository Libraries

The reaction of Li-6(Li-6 alpha)2 alpha from 4 to 24 MeV incident energy is presented. The experiment was carried out with a Van de Graaff EN Tandem. The target was made of 20 microgram per square centimeter Li-6 deposited on a 20 microgram per square centimeter carbon backing. The beam was monitored by a Faraday cup. The alpha particles were registered by 10 solid state detectors evenly spaced from 20 to 155 degrees and for 14 different energies. The angular distribution and excitation functions of Li-6(Li-6 alpha)Be-8 ground and first excited state were measured.
Author (NSA)

N70-33295# Paris Univ., Orsay (France). Faculte des Sciences.
MEASUREMENT OF LUMINOSITY DURING AN EXPERIMENT ON THE ORSAY COLLISION RINGS
Pierre Petroff (Ph.D. Thesis) 1970 74 p refs In FRENCH
(RI-70-1) Avail: AEC Depository Libraries

This measurement was made with a precision of several percent by recording the counting rate by double bremsstrahlung reaction. An automatic recording procedure for the data was developed, and the acquisition data are described. The magnetic bands were analyzed on the Univac 1108 computer. The asymmetry of the spectra of the marked photons was studied, especially with respect to the study of a background in the sandwich computers. The results show that this method of measurement of the luminosity is very precise due to the high counting rate of the normalization reaction used, the absence of background because of the high vacuum in the experimental section, the use of a coincidence system to detect the double bremsstrahlung photons, and the simplicity of the detection apparatus. The very sharp angular distribution of the photons emitted makes it possible to use small-dimension counters having a good energy resolution.
Author (NSA)

N70-33301# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THE PROGRAM ELF-NEUTRON
Francois Gervaise Feb. 1970 32 p refs In FRENCH
(CEA-N-1255) Avail: AEC Depository Libraries

The program ELF-NEUTRON makes it possible to study the propagation of neutrons in cylindrical and spherical geometries, using cross sections given by the AWRE tape. In the case of a cylindrical geometry, the external contour can be circular or polygonal, the limiting conditions at this contour being either a vacuum, or total reflection. The preparation of the cross sections, the study of the variance, and the drawing of the curves showing the cross sections and the spectra are obtained almost automatically using auxiliary programs. Author (NSA)

N70-33302# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
POLARIZATION MEASUREMENTS ON THE ELASTIC SCATTERING OF 52-MeV DEUTERONS ON CARBON WITH THE HELP OF A DOUBLE-SCATTERING EXPERIMENT
K. Weigele Jul. 1969 51 p refs
(NP-18071) Avail: AEC Depository Libraries

Due to spin-dependency of nuclear forces, particles that originate from nuclear reactions or that are scattered by a nucleus are generally polarized. If these particles are subjected to a second scattering, the angular distribution will show an asymmetry. By measuring the parameters of asymmetry, the degree of polarization can be determined. At the isochroncyclotron 52-MeV deuterons were polarized by scattering on carbon and the polarization determined by a subsequent scattering. Qualitatively, the experimental findings agreed with predictions derived from an optical model; however, quantitatively, considerable discrepancies existed. Author (NSA)

N70-33303# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF SOME PROPERTIES OF EXCITED LEVELS OF THE COMPOUND NUCLEI FORMED BY THE INTERACTION OF SLOW NEUTRONS WITH Rh 103, Xe, Gd 155, Gd 157, AND Th 232
Pierre Ribon (Ph.D. Thesis—Paris Univ.) Dec. 1969 275 p refs In FRENCH
(CEA-N-1149) Avail: Issuing Activity

The scattering and total neutron cross sections for the above mentioned nuclei were measured up to about 4 keV (up to 200 eV for gadolinium isotopes) by the time of flight method. Parameters of several hundred resonances were determined, using the technique of shape analysis, and the average values of strength functions radiation width and average level spacing were deduced from them. Experimental distributions of these parameters are generally in good agreement with theoretical laws. Some disagreements concerning the neutron reduced width distribution seem significant. Author (NSA)

N70-33304# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique.
ALGEBRAIC APPROACH TO QUANTUM SCATTERING THEORY
J. M. Combes 1969 37 p refs
(CNRS-CPT-69-P-315) Avail: AEC Depository Libraries

In the theory of scattering by long range potentials, the asymptotic behavior of operators was investigated. A weak asymptotic condition was introduced, and the mathematical consequences of that condition were discussed. Then the existence of asymptotic algebras in potential scattering by a control field or a two particle interaction was studied. Author (NSA)

N70-33315# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ON THE ROLE OF RHO- AND SIGMA-MESONS IN STRONG INTERACTIONS
V. I. Lendyel and D. M. Marina 1969 18 p refs Presented at the Conf. on High Energy Phys. and Theory of Elementary Particles, Kiev
(ITF-69-90; Conf-691035-5) Avail: AEC Depository Libraries

The universal formulas for the contribution of rho and sigma mesons in different strong interaction processes are obtained. It is shown that within a certain accuracy a selfconsistent description of the strong interaction processes of elementary particles can be obtained by means of these formulas. Author (NSA)

N70-33333# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.
DATA FOR THE CALCULATION OF GAMMA RADIATION SPECTRA FROM FISSION PRODUCTS
B. S. J. Davies Jan. 1970 114 p refs
(RD/B/M-1551; JNPC/SWP/P-160) Avail: AEC Depository Libraries

A complete set of available data on the properties of the fission products of U-235, U-238, Pu-239, and Pu-241 is presented. The compilation covers fission yield, half-life, gamma radiation energy and intensity, and thermal neutron cross-section for fission chains of mass number 72 to 161. The gamma radiation spectrum is given as the number of photons per 100 disintegrations in each of a set of 10 keV-wide bands. NSA

N70-33339# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
A METHOD FOR EXTRACTING CONCENTRATION PROFILES AT THE SURFACE OF A BINARY MIXTURE FROM CAPTURE-GAMMA MICROPROBE DATA
Gerald M. Padawer Jul. 1970 16 p refs
(RM-480) Avail: CFSTI

To be intelligible to the metallurgist, nuclear microprobe data must be so refined and transformed that it displays the actual depth distribution of the chemical element studied. To that end a mathematical method is presented for calculating the explicit concentration profiles of the two components in a binary mixture from the capture-gamma excitation function of either one of them. The model is subject to the condition that a linear relationship obtain between the concentration of the solute and the concentration of its host. Author

N70-33346# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE AVERAGE IONIZATION ENERGY IN GASEOUS MIXTURES
Jacqueline Rolland (Ph.D. Thesis) Feb. 1970 91 p refs In FRENCH
(CEA-N-1271) Avail: AEC Depository Libraries

Measurements of W, the average energy of ionization by alpha particles, were carried out in pure Ar and Kr, in the binary mixtures Ar-CH4, Ar-Kr, Kr-CH4, Ar-H2, and in the ternary mixtures Ar-CH4-H2 and Ar-CH4-Kr. The results obtained for the Ar-H2 mixture are in good agreement with the law giving the variation of W for binary mixtures. In the concentration range studied, the same law can be applied to the Ar-CH4-H2 mixture if the Ar-CH4 mixture is considered as a single component. The results obtained for Ar-Kr and Ar-CH4-Kr mixtures show that krypton and methane behave differently with respect to the various excited states of the argon atoms. A series of reactions that can explain the experimental data is given, in particular for the Ar-Kr mixture. Author (NSA)

N70-33355# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
NEW E TIMES B ELECTRON ENERGY ANALYZER. MEASUREMENT OF DISTRIBUTION FUNCTIONS
Jacques Launspach (Ph.D. Thesis—Paris Univ.) Feb. 1970 73 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-539) Avail: Issuing Activity

An E × B electron energy analyzer which can be used in a weak magnetic field is presented. The focusing properties of the charged particles in crossed fields are used to obtain a large energy working range (.1 to 60 keV). The energy resolution is computed for different values of the parameters of the analyzer. As an example, the electron distribution function of the flux scattered through the mirrors of a magnetic bottle is measured and compared to the theoretical model obtained from the Boltzmann equation in which the electron-neutral collision term is dominant. NSA

N70-33357# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
NIMROD OPERATION AND DEVELOPMENT, 1 APRIL–30 JUNE 1969
D. E. Gray, ed. Nov. 1969 23 p
(RHEL/R-188) Avail: AEC Depository Libraries, HMSO 4s; BIS $0.80

Details are given of Nimrod operation during April 1 to June 30, 1969, and of the particle physics experimental program undertaken. NSA

N70-33360# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
THE TOTAL PAIR PRODUCTION CROSS SECTION IN HYDROGEN AND HELIUM. PART 2: CORRECTION TO THE JLS VALUE FOR ALPHA SUB T
T. M. Knasel Jan. 1970 15 p refs
(DESY-70/3) Avail: AEC Depository Libraries

A comparison of the Jost, Luttinger and Slotnick formula for the total pair production cross section to more recent theoretical work by Maximon, (for total coherent pair production), and by Mork (for total incoherent pair production) is presented. If one neglects the effect of atomic screening then the coherent and incoherent cross sections will be identical except for small corrections important only at low photon energies. The result of the comparison shows that the Jost, Luttinger and Slotnick formula (for coherent production) agrees with the formula of Maximon to better than 1 part per 1000 above 5 MeV. A very simple approximate formula for the total coherent (unscreened) pair production cross section is given. Finally a comparison of the difference between the Mork calculation for the unscreened incoherent cross section with the JLS formula gives the correction term that must be applied to the JLS formula in the incoherent case (called the retardation correction). The addition of screening correction and the retardation correction to the JLS formula then gives the most precise value for the total pair production. Comparison with recent experimental data shows good agreement. Author (NSA)

N70-33370 Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
PRODUCTION OF OMEGA VECTOR MESONS BY ELECTRON-POSITRON ANNIHILATION (DETECTION OF THE MODE PION(+) PION(−) PION (0)). INDICATION OF AN INTERFERENCE RHO MESON (0)-OMEGA MESON IN THE MODE PION(+) PION(−) [PRODUCTION DU MESON VECTORIEL OMEGA PAR ANNIHILATIONS ELECTRONS-POSITRONS (DETECTION DU MODE PION(+) PION(−) PION(0)). INDICATION D'UNE INTERFERENCE RHO MESON(0)-OMEGA MESON DANS LE MODE PION(+) PION(−)]
Francis Laplanche (Ph.D. Thesis) Jan. 1970 77 p refs In FRENCH
(LAL-1229) Copyright. Avail: Issuing Activity

Spark chambers and scintillation counters were used to study the interactions positron + electron yields positive pions + negative pions + neutral pions and positron + electron yields positive pions + negative pions in colliding beams. Omega meson production is found in the first interaction, and rho meson-omega meson interference is found in the second. The cross section is given for the positron + electron yields positive pions + negative pions + neutral pions and first interaction, and the branching ratio and partial width of the omega meson in positron + electron interactions are determined. NSA

N70-33392# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
ROTATIONAL ENERGY OF A TWO-PARTICLE SYSTEM [ENERGIYA VRASHCHENIYA SISTEMY DVUKH CHASTITS]
E. V. Gai 1969 21 p refs In RUSSIAN
(FEI-159) Avail: AEC Depository Libraries

The energy of a quantum system is considered as a function of the angular momentum 1 for different potential. Particular attention is given to the limit of the high rigidity of the potential. Specific examples are given to show the existence of a null rotational energy of the system, the relationship between the rigidity of the effective potential and the ratio of the excitation energy of a vibrational level to the excitation energy of a rotational level. A relationship is also shown between the dependence of the position of the minimum of the effective potential on 1 and the dependence of the rotational energy of the system on 1. NSA

N70-33394# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
THE CONNECTION OF THE KINEMATICAL CUT WITH THE S-MATRIX ON THE MASS SHELL FOR THE TWO CHANNEL SCATTERING
M. L. Kharakhan and Yu. M. Shirokov 1969 13 p refs In RUSSIAN; ENGLISH summary Presented at 3d Conf. Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1969
(ITF-69-83) Avail: AEC Depository Libraries

An explicit expression is derived connecting the physical S-matrix with the jump through the kinematical cut of the matrix element (2/H(x)10) of the scalar field for the two channel case. This is the direct generalization of a previous corresponding result for the one-channel case. Author (NSA)

N70-33397# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
PHOTODISINTEGRATION OF HE 3 BY POLARIZED GAMMA RAYS
F. L. Fabbri, P. Picozza, and C. Schaerf 23 Dec. 1969 4 p refs *Its* Nota Interna No. 463
(LNF-69/82) Avail: CFSTI

The preliminary results of the reaction gamma plus He-3 yields proton plus deuteron with linearly polarized bremsstrahlung are studied to determine the nonresonant dipole transitions. Electromagnetic transitions of the three-nucleon systems from the ground state to the continuum of two particles, with angular distributions are discussed. The results indicate that the asymmetry parameter is 0.36 plus or minus 0.08 at a CMS angle of 90 deg and a gamma ray energy of 260 MeV. F.O.S.

N70-33398# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
PHOTOPRODUCTION OF ETA-MESONS ON NUCLEONS AT HIGH ENERGIES
N. A. Kobylinskii 1970 12 p refs In RUSSIAN; ENGLISH

summary
(ITF-70-2) Avail: AEC Depository Libraries

Processes of photoproduction of eta-mesons on nucleons at high energies are considered within the frameworks of a model taking into account rho and omega poles and rho P and omega P cuts. Pole residues and cut discontinuities for the amplitude of eta-meson production are connected with those for pi-meson production by SU(6)-symmetry and vector dominance model. Present experimental data and a number of predictions can be made using this model. Author (NSA)

N70-33400# Akademiya Nauk URSR, Kiev. Inst. Teoraticheskoi Fiziki.
ANALYTICAL PROPERTIES OF THE EXACTLY SOLUBLE NONRELATIVISTIC TWO CHANNEL SCATTERING PROBLEM
M. L. Kharakhan 1970 23 p refs In RUSSIAN; ENGLISH summary
(ITF-70-5) Avail: AEC Depository Libraries

The exactly soluble nonrelativistic example is investigated for the problem of the two-channel scattering of the two neutral spinless bosons. The explicit form for the S-matrix is derived in the form of the quotient of the matrixes of the Jost type. A previous suggestion is checked about the identities, S sub 12 = S sub 21 = 0, S sub 22 = 1 in the region between the thresholds. It is demonstrated that these can be violated. The connection is observed between the identities and the T-invariance condition. The peculiar features of the scattering and reaction cross section are investigated for the case of the presence of the pole on the nonphysical sheet of the upper threshold in the region between the thresholds. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-32083# Michigan Univ., Ann Arbor. Electron Physics Lab.
TURBULENT PLASMA HEATING Final Report
J. E. Row and W. D. Getty Feb. 1970 31 p refs
(Grant NSF GK-1708)
Avail: Issuing Activity

Research in plasma physics is reported and includes: (1) anomalous diffusion in a cylindrical plasma column above the critical magnetic field; (2) nonlinear two-stream interactions; (3) numerical experiments on a one-dimensional finite-length beam plasma system; (4) pulsed beam plasma interaction and suppression of convective instabilities; (5) beam plasma interaction near the lower hybrid frequency. D.L.G.

N70-32101*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
EXPERIMENTAL INVESTIGATIONS OF A URANIUM PLASMA PERTINENT TO A SELF SUSTAINING PLASMA SOURCE Annual Technical Report, 1 Jan. –31 Dec. 1969
Richard T. Schneider, C. D. Kylstra, and H. D. Campbell May 1970 50 p refs
(Grant NGR-10-005-089)
(NASA-CR-110626) Avail: CFSTI CSCL 20I

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1. BOILING POINT OF URANIUM A. G. Randol, III (Nuclear Fuel Services, Inc.), R. T. Schneider, and C. D. Kylstra 14 p refs (See N70-32102 17-17)

2. SPECTROSCOPIC STUDY OF A URANIUM ARC PLASMA H. D. Campbell, R. T. Schneider, C. D. Kylstra, and A. G. Randol, III (Nuclear Fuel Services, Inc.) 21 p refs (See N70-32103 17-25)

3. GENERATION OF A FISSIONING PLASMA C. D. Kylstra and R. T. Schneider 11 p refs (See N70-32104 17-25)

N70-32103*# Florida Univ., Gainesville.
SPECTROSCOPIC STUDY OF A URANIUM ARC PLASMA
H. D. Campbell, R. T. Schneider, C. D. Kylstra, and A. G. Randol, III (Nuclear Fuel Services, Inc.) *In its* Exptl. Invest. of a Uranium Plasma Pertinent to a Self Sustaining Plasma Source May 1970 21 p refs (See N70-32101 17-25)
Avail: CFSTI CSCL 20I

Measurements of temperatures, particle densities, emission and absorption coefficients of a uranium arc are reported. Spectroscopic diagnostics were used throughout the investigation. Several methods of temperature determination were employed including Boltzmann plots, relative line intensities and brightness emissivity methods. Although there are difficulties associated with each method, all temperature measurements were found to lie in the range of 7500-12,000 K. The measurements of emission and absorption coefficients of the plasma were taken over the pressure range of 3-15 atmospheres and current range of approximately 15-50 amperes. The corresponding partial pressure of uranium over this range was estimated to be 0.1 - 0.5 atmospheres. Author

N70-32104*# Florida Univ., Gainesville.
GENERATION OF A FISSIONING PLASMA
C. D. Kylstra and R. T. Schneider *In its* Exptl. Invest. of a Uranium Plasma Pertinent to a Self Sustaining Plasma Source May 1970 11 p refs (See N70-32101 17-25)
Avail: CFSTI CSCL 20I

The measurement of the radiation emission properties of a uranium plasma was made on thermally excited plasmas. That is, an electrical discharge, either RF or DC, is used to supply energy to the plasma by electron-atom, electron-ion collisons. A fissioning uranium plasma experiment was conducted. Author

N70-32108*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CALCULATION OF THE EQUILIBRIUM PROPERTIES OF PLASMAS
Sheldon Heimel *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 17–29 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 20I

The calculation of the equilibrium properties of plasmas is an important subject because many physical situations in space technology involve plasmas. For example, the entry of a high-speed probe into a planetary atmosphere causes shock-ionization. The proper design of a heat shield for such a probe and the choice of an entry pattern requires knowledge of chemical compositions and thermodynamic properties of plasmas. Other situations involving plasma properties are rocket exhausts, thermionic diodes, and magnetohydrodynamic power generators. The topics that will be covered in this paper are as follows: (1) the place of plasma calculations in the context of equilibrium calculations; (2) the problems involved in plasma calculations, both theoretical and practical; (3) the effect of the assumptions used in the calculations, as illustrated by hydrogen and lithium plasmas; and (4) the effect of the composition model for the atmosphere of the planet Jupiter on its high-temperature properties. Author

N70-32224# Syracuse Univ., N.Y. Dept. of Electrical Engineering.
STUDIES OF CAVITY RESONATORS CONTAINING MAGNETOPLASMAS
Gordon Kent and Donald G. Thomas Feb. 1970 44 p refs
(Grant AF-AFOSR-1266-67)

(AD-703743; TR-70-1; AFOSR-70-0521TR) Avail: CFSTI CSCL 20/9

The paper deals with cylindrical cavity resonators containing weakly ionized gases, principally argon, in the pressure range of 0.05 to 0.1 Torr. The plasma, produced either by microwave or dc power, is magnetized by a uniform axial field. Measurements of resonant frequency, made over a range of plasma densities and magnetic field are compared with the calculations of the theory given by Kent. The agreement is good providing the cylindrical degeneracy of the cavity is preserved and the plasma is reasonably uniform. Experimental and analytical results are used to evaluate perturbation theory, and some simple formulas, useful for diagnostic purposes, are given. A perturbation method for correcting the theory to account for symmetrical nonuniformities is proposed, and it is applied to the experimental data with apparent success. The method offers the possibility of determining both uniformity and density from measurements of frequency in one microwave band. Author (TAB)

N70-32343# Technische Hogeschool, Eindhoven (Netherlands).
ON FLUCTUATIONS IN PLASMAS
Gerhard Johan Dalenoort (Ph.D. Thesis) 1970 120 p refs Sponsored in part by Ned. Organisatie voor Zuiver-Wetenschap. Onderzoek. and EURATOM
Avail: CFSTI

In the Holtsmark model it is possible to give a reasonable account of the aspects connected with the individuality of particles, whereas in the continuum model collective interactions may be accounted for. A mixed model is introduced which combines the favorable features of each of the separate models. Numerical results are presented on probability distributions of the electric microfield which are compared with other work. The analytic results include time-dependent distributions and correlation functions. Author

N70-32369# Naval Postgraduate School, Monterey, Calif.
INVESTIGATIONS IN THE VACUUM ULTRAVIOLET OF A STEADY STATE NITROGEN PLASMA
James Carlin Beam (M.S. Thesis) Jun. 1969 84 p refs Sponsored in part by NOL
(AD-705081) Avail: CFSTI CSCL 7/4

In preparation for studies of shock waves in a collisionless plasma, a grazing incidence vacuum spectrograph has been used to study the vacuum ultraviolet spectra of a nitrogen plasma. The spectra are formed by a concave grating with a 1-meter radius of curvature and recorded on Kodak SWR (Shortwave-Radiation) Film. Analysis of the spectra was by comparison with helium and argon spectra, with intensity information from densitometric measurement. Relative intensity determination provides an electron temperature evaluation technique. Details on the modification of the Naval Postgraduate School plasma facility to accommodate a theta-pinch shock generation experiment are presented. A total of 735 lines was observed in the range 300-2000 angstroms. Relative intensity measurements indicated electron temperatures in the range 7.3 to 19.7 electron volts. Author (TAB)

N70-32370# Bar-Ilan Univ., Ramat-Gan (Israel).
ANALYSIS OF THE VELOCITY FIELD IN PLASMAS FROM THE DOPPLER BROADENING OF SPECTRAL EMISSION LINES
Asher S. Kaufman Dec. 1969 120 p refs
(Contract F61052-68-C-0005)
(AD-705155) Avail: CFSTI CSCL 20/9

A critical and systematic review of the analysis of the velocity field is presented, together with some original contributions. The source of radiant energy is taken to be a hot, optically-thin plasma. The opening chapters are devoted to a discussion of the kinetic temperature and mass-motion in a plasma, followed by a criterion of distinguishing between the two forms of motion. The experimental methods of separating thermal motion from random mass-motion (named commotion) are then classified. The larger part of the paper is devoted to the method of separation called the method of different ionic species, in which the broadening of spectral lines from these species is measured. It is concluded that in view of the severe restrictions placed on this method, it can only be used successfully in special cases rather than generally. Author (TAB)

N70-32444# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME LUMINOSITY CHARACTERISTICS OF A DECAYING DISCHARGE PLASMA IN CESIUM VAPOR
N. D. Morgulis et al 3 Mar. 1970 10 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Ukrania SSR), v. 14, no. 3, 1969 p 507–509
(AD-704752; FTD-MT-23-50-70) Avail: CFSTI CSCL 20/9

Spectroscopic investigation of the anomalous behavior of the luminosity of a decaying arc-discharge cesium plasma. The anomalous nature of the emission of the spectral lines is attributed to the combined effect of the intrinsic monotonic emission of a given excitation level and the complex nonmonotonic emission associated with the population of the level due to cascade recombination of the atomic cesium ions in the plasma. Author (TAB)

N70-32462*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THE EXCITATON OF ION BURSTS FROM GRIDS
Georg Knorr 16 Apr. 1970 28 p refs
(Grants NGL-16-001-043; Contract AT(11-1)-2059)
(NASA CR-110643; Rept-70-19) Avail: CFSTI CSCL 20I

Experiments on ion bursts with a step function excitation of a grid are investigated theoretically. After the description of particle distributions and potentials in the sheath region, the ideal response of a probe located at a distance from the grid is calculated. It is shown how the declining part of the response function depends on the sheath characteristics. It is estimated that it should not be impossible to measure directly the far field of test particles in the initial part of the response function. Author

N70-32467*# Scientific Translation Service, Santa Barbara, Calif.
CROSSED FIELD ELECTRON ANALYZER AND ITS APPLICATION TO THE MEASUREMENT OF A DISTRIBUTION FUNCTION [ANALYSEUR D'ELECTRONS A CHAMPS CROISES ET SON APPLICATION A LA MEAURE D'UNE FONCTION DE DISTRIBUTION]
J. Launspach Washington NASA Jul. 1970 83 p refs Transl. into ENGLISH from Report EUR-CEA-FC-529, Feb. 1970 p 1–73
(Contract NASw-2035)
(NASA-TT-F-13031; EUR-CEA-FC-529) Avail: CFSTI CSCL 20I

An E x B analyzer which can be used in a weak magnetic field is presented. The focusing properties of the charged particle trajectories in crossed fields are used to obtain a large working range (.1 to 60 keV). The energy resolution is computed for the general case. As an example, the electron distribution function of the flux scattered through the mirrors of a magnetic bottle is measured and compared to the theoretical model derived from the Boltzmann equation with an electron-neutral collision term. Author

N70-32470*# Columbia Univ., New York. Electronics Research Labs.
DIAGNOSTIC STUDY OF THE FLUID TRANSPIRATION ARC Final Report, 1 Apr. 1964–31 Mar. 1969
C. Sheer, S. Korman, C. G. Stojanoff, and P. S. Tschang Mar. 1969 150 p refs Supported in part by NASA

(Contract AF 49(638)-1395)
(NASA-CR-110717; F-1/312; AFOSR-70-0195TR) Avail: CFSTI CSCL 20I

The fluid transpiration arc in combination with the fluid convection cathode was investigated. Various arc configurations and operating techniques are described. Preliminary theoretical treatments of the interaction phenomena due to gas injection through a porous anode and through a tightly shrouded cathode nozzle with the arc discharge are carried out. Good agreement is shown in some respects although several anomalies are found which are attributed to deficiencies in the modelling. Several diagnostic techniques were developed, including a Hall magnetic probe, a thermocouple probe, a fiber optics probe, and a Pitot tube probe. The cause of arc ignition damage to electrodes was investigated and corrected. The radiation characteristics of a combination arc source featuring a collinear geometry for the fluid transpiration anode and fluid convection cathode were also investigated. Improved performance in conversion efficiency and luminous efficacy was demonstrated along with a favorable brightness profile. Author

N70-32493*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
DOUBLE LANGMUIR PROBE MEASUREMENTS IN A MAGNETIZED POSITIVE COLUMN
V. C. Dunham 15 May 1970 78 p refs
(Grant NGL-39-009-003)
(NASA-CR-110646; SR-356) Avail: CFSTI CSCL 20I

A study is presented of the positive column of a cold cathode, cylindrical glow discharge in nitrogen (.2 and 1.0 torr) under the influence of a small, approximately uniform, longitudinal magnetic field (0-200 gauss). To supply a background for the study, a survey is made of the theories of glow discharges and both single and double probes with and without magnetic fields. Using double cylindrical probes, measurements were made in the positive column to determine the effect of the magnetic field on the electron temperature and density. For B = 0, the temperature and density are shown to agree with the theory, the former being constant across the column, and the profile of the latter being described by the zero order Bessel function. For B > 0, the temperature decreases more rapidly than the theory predicts for increasing B, but becomes constant for B = 100-200 gauss. The axial density is shown to increase nearly at the rate predicted by the theory. Author

N70-32562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INTERACTION BETWEEN LOCAL CURRENTS INDUCED IN A PARTIALLY IONIZED GAS FLOW AND A MAGNETIC FIELD
G. P. Petrova 26 Mar. 1970 11 p refs Transl. into ENGLISH from the book 'Fizicheskaya Gazodinamika Ionizirovannykh i Khimicheski Reagiruyushchikh Gazov' Moscow, Izd-vo Nauka, 1968 p 48-51
(AD-705162; FTD-HT-23-148-70) Avail: CFSTI CSCL 20/9

An expression for the magnitude of the induced voltage generated during the flow of an ionized, conducting gas in a transverse magnetic field was derived. This derivation is based on the solution of a differential equation. The flow velocity vector, the time, the flow density, the pressure, coefficient of viscosity, a conductivity coefficient, density of external forces given where the magnetic vector and an induced current density is given where the electric conductivity, the electric field vector, and the velocity of an infinitesimal mass of gas is shown. The final expression for the induced voltage is given. Author (TAB)

N70-32565# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
DIRECT MEASUREMENT OF THE MAINTENANCE VOLTAGE OF A THERMAL INDUCTION PLASMA, JUNE 1968-DECEMBER 1969
Hans U. Eckert 30 Jan. 1970 22 p refs
(Contract F04701-69-C-0066)
(AD-705134; TR-0066(9220-02)-6; SAMSO-TR-70-148) Avail: CFSTI CSCL 20/9

The axial distribution of voltage induced near the inner wall of a 3.8-cm-diameter tube confining an rf argon induction plasma at atmospheric pressure was measured at a flow rate of 115 cc/sec with a watercooled ring probe. Also measured as functions of probe position were the excitation frequency, voltage, and current on the inductor coil. The plasma reduced the probe voltage to about 60% of its value in the absence of the plasma. After correction for the effects of cooling and displacement of the plasma by the probe, the total induced voltage around the circumference of the plasma at the midsection was found to be 64 V. The corresponding value for electric field intensity was 6 V/cm. This value falls between published values obtained by indirect methods and is in fair agreement with prediction on the basis of a one-dimensional theory. Author (TAB)

N70-32681*# Catholic Univ. of America, Washington, D.C. Dept. of Space Science and Applied Physics.
THE METHOD OF CHARACTERISTICS FOR SUPERSONIC FLOW OF A GUIDING CENTER PLASMA
Y. C. Whang Jun. 1970 28 p refs
(Grant NGR-09-005-063)
(NASA-CR-110656) Avail: CFSTI CSCL 20I

A study of the compressive magnetoacoustic waves in a guiding center plasma shows that the wave front that emerges from a point disturbance after a finite time is a simple oblate spheroid with the axis of revolution parallel to the field lines. Thus in a steady, three-dimensional supersonic flow of guiding center plasma, a simple analytic expression can be obtained to represent the characteristic surfaces. From a proper linear combination of the governing macroscopic equations, the chacteristic equation is obtained. It represents the propagation of disturbances on the characteristic surface. The characteristic theory can be used to study the interaction of the solar wind with the moon and possibly with other planetary bodies. Author

N70-32730# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
NUMERICAL AND ANALYTICAL INVESTIGATION OF NONLINEAR PROPERTIES OF THE VLASOV EQUATION AND OF PLASMAS Progress Report
Georg E. Knorr Mar. 1970 27 p refs
(Contract AT(11-1)-2059)
(COO-2059-1) Avail: CFSTI

The following sections are included: relation between characteristic transform and Hermite expansion; cut-off procedure in transformed velocity space-applications to linear and nonlinear theory; nonlinear program using power transform-comparison between nonlinear and quasilinear theory (4) nonresonant particle contributions in quasilinear theory; (5) finite-difference scheme for Vlasov's equation; and electron motion for slow processes in plasmas. NSA

N70-32731# Princeton Univ., N.J. Plasma Physics Lab.
THE ACCELERATION CALCULATION FROM A SCALAR POTENTIAL
Jay P. Boris Mar. 1970 29 p refs
(Contract AT(30-1)-1238)
(MATT-769) Avail: CFSTI

Optimization of large computational-physics codes demands that close attention be paid to both speed and accuracy. During the acceleration calculation for stellar and plasma dynamics, sizeable improvements in both speed and accuracy are possible for no great investment of programming effort. Two aspects of the acceleration

calculation.calculation of the acceleration vector field on a grid from the potential specified on that grid and interpolation from the grid to the location of an arbitrarily placed particle, are treated. Although these two aspects of the calculation are discussed from the plasma-physics point of view, the applicability of the new techniques presented here extends to stellar, molecular fluid, and pseudo-fluid calculations using a regular rectangular grid. A 6-point difference formula for finding the acceleration field from the potential is described. This formula symmetrizes the difference-derived anisotropic errors in the acceleration, thus permitting errors in collective modes to be reduced from 1 or 2% in a typical case. Author (NSA)

N70-32744# California Univ., Livermore. Lawrence Radiation Lab.

ASTRON PLASMA PARAMETERS CONFINED IN THE CLOSED MAGNETIC WELL OF A PROTON E-LAYER

N. C. Christofilos 8 Sep. 1969 13 p refs Intern. Conf. on Nucl. Fusion Reactors, Culham, Engl., 17-19 Sep. 1969 Submitted for publication Sponsored by AEC

(UCRL-71769-Rev-1; CONF-690901-8) Avail: CFSTI

A relativistic proton E layer of energy of 2 GeV is formed in a 100 kG field. The outer radius of the E layer is approximately 180 cm and its length 800 cm. The combination of the external magnetic field and the field of the proton E layer forms a closed pattern of magnetic lines known as closed magnetic well within which plasma is confined. The plasma radius is 125 cm and its length approximately 300 cm. Coulomb interactions of the relativistic protons with the confined plasma can heat the plasma up to a temperature of 10 keV even if the plasma lifetime is limited by anomalous diffusion to 140 Bohm lifetimes. The ions are trapped in the E layer by dissociation. Approximately 700 MW of the energy required to sustain the E layer is trapped in the system. Thus the total thermal power released (excluding the plasma losses) is 11,200 MW. The net electric power produced, assuming a 50% efficiency of the power generation plant, is 5600 MW. Author (NSA)

N70-32797# Oak Ridge National Lab., Tenn.

MAGNETIC FIELD OF A CURRENT LOOP IN A TOROIDAL CONDUCTOR

P. B. Burt (Clemson Univ.) Apr. 1970 7 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2895) Avail: CFSTI

In the limit of indefinitely large conductivity, the magnetic field of a current loop enclosed by a conductor is itself completely enclosed by the conductor. The total field consists of the vacuum field in the absence of walls and the field due to the image currents in the walls. The current loop must be in equilibrium with these fields. As the first step in the study of toroidal equilibria the magnetic field due to an axially symmetric current loop in the interior of a toroidal conductor of arbitrary aspect ratio, circular cross section, and indefinitely large conductivity is calculated. Author (NSA)

N70-32813# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.

NONLINEAR OSCILLATIONS OF A MAXWELLIAN PLASMA

Hari K. Sen and Pradip M. Bakshi (Brandeis Univ.) Jan. 1970 14 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gasses, Bucharest, 1-6 Sep. 1969 /ts Environ. Res. Paper No. 310

(AD-702081; AFCRL-70-0014; ERP-310) Avail: CFSTI CSCL 20/9

Exact non-linear wave solutions are obtained for waves stationary in a uniformly moving frame for the case of a Maxwellian electron plasma in a uniform ion background. It is found that there are no waves below a minimum wave velocity; anharmonic waves develop above the critical velocity, but only up to a maximum amplitude, depending on the wave velocity; frequency amplitude relations indicate that small amplitude linearized theory is not a good approximation, except for large wave velocities; and in the limit of zero amplitude, twice the frequency of oscillation given by linearized theory for any wave velocity is obtained. Author (TAB)

N70-32818*# Techtran Corp., Glen Burnie, Md.

INVESTIGATIONS OF PULSED DISCHARGES IN A DIELECTRIC CHANNEL WITH ABLATING WALLS [ISSLEDOVANIYA IMPUL SNYKN RAZRYADOV V DIELEKTRICHESKOM KANALE S ABLIRUYUSCHIMI STENKAMI]

Yu. P. Rylov et al Washington NASA Jul. 1969 8 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, 1969, p 52-55

(Contract NASw-2037)

(NASA-TT-F-13009) Avail: CFSTI CSCL 20I

Research was conducted on the volt-ampere characteristics of a pulsed discharge in a hollow cylindrical channel formed by walls of a dielectric. Measurements are made of erosion of the channel walls and average velocity of plasma flowing out into a vacuum through an aperture in one of the electrodes as a function of channel geometry. Inferences are made about plasma temperature and a mechanism of heat transfer to the wall. Author

N70-32864*# Scientific Translation Service, Santa Barbara, Calif.

DIFFRACTION OF CYLINDRICAL WAVES ON A PERFECTLY CONDUCTING WEDGE IN AN ANISOTROPIC PLASMA [DIFRAKTSIYA TSILINDRICHESKIKH VOLN NA IDEALNO PROVODYASHCHEM KLINE V ANIZOTROPNOY PLAZME]

M. S. Bibrovnikov Washington NASA Jul. 1970 19 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 5, 1968 p 19-30

(Contract NASw-2035)

(NASA-TT-F-13067) Avail: CFSTI CSCL 20I

The problem of diffraction of cylindrical waves by a perfectly conducting wedge in an anisotropic plasma is formulated and solved. The integral equations for the field are reduced to functional equations which are solved with the aid of a special function. The properties of this function are studied. The general solution is represented in the form of a double contour integral on the complex variable plane. An analysis is made of the radiation field and surface waves for several particular cases: a source of cylindrical waves at the apex, at infinity, and others. Diffraction by a half-plane is studied separately. Author

N70-32976*# Avco-Everett Research Lab., Everett, Mass.

FORMATION OF STRIATIONS IN IONOSPHERIC PLASMA CLOUDS

L. M. Linson and J. B. Workman Dec. 1969 27 p refs

(Contracts NASw-1400; DASA01-69-C-0055)

(NASA-CR-110652; RR-308) Avail: CFSTI CSCL 20I

It is suggested that a low frequency instability, sometimes called the crossed field instability, may be important for the formation of striations in arium ion clouds released in the ionosphere above the E-layer. The theory predicts that the trailing edge (with respect to the neutrals) of the plasma cloud will be unstable while the leading edge is stable, in qualitative agreement with observations. The growth time is relatively independent of wavelength and is of order d/U where d is the typical density gradient length and U is the velocity of the cloud with respect to neutrals. Predicted growth times varying from seconds in the auroral zone at high latitude to minutes at midlatitudes are also in agreement with observation. Wavelengths of waves with zero phase velocity are approximately = 2 pi d which can be verified by optical observations. Author

N70-33023# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE POPULATION OF HIGHLY EXCITED LEVELS IN RAREFIED PLASMA
I. L. Beigman et al [1970] 6 p refs Transl. into ENGLISH from Russian preprint, 1969 12 p
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The dependence of the population of highly excited levels on "n" is investigated for cases when the fundamental processes for direct population of these levels are photo-recombination, atom excitation from the ground state, and dielectronic recombination. The study of the population of highly excited levels is of interest to investigations of physical conditions in gas nebulae, high temperature plasma, and other objects. For a sufficiently low plasma density, the decay in the levels is due entirely to radiative processes. The population of the level n can occur both because of direct processes and because of cascade radiative processes.
Author

N70-33045# California Univ., Livermore. Lawrence Radiation Lab.
INSTABILITY OF CHARGED PARTICLE BEAMS IN PLASMA
M. V. Nezlin Dec. 1969 87 p refs Transl. into ENGLISH from Russian Rept. IAE-1882
(UCRL-Trans-10437) Avail: CFSTI

Theoretical and experimental data on the instabilities associated with charged-particle beams in plasmas are reviewed. Results obtained in this study on the well-defined nonlinear effects observed in experiments with high-intensity electron beams in plasma are analyzed.
NSA

N70-33111# Toulouse Univ. (France). Faculty of Sciences.
STUDY OF INSTABILITIES IN HIGH FREQUENCY ELECTRIC DISCHARGES [CONTRIBUTION A L'ETUDE DES INSTABILITES DANS LES DECHARGES ELECTRIQUES DE HAUTE-FREQUENCE]
Jean Soum (Ph.D. Thesis) 1970 129 p refs In FRENCH; ENGLISH summary
(NP-18188) Avail: AEC Depository Libraries

In plasmas created by a high-frequency electric field, comparisons were made between electron temperature experimental measurements and provisions deduced from a simplified theory. The influence of metastable neutral atoms on the plasma ionization, the values of the electron temperature, and its variation with pressure and hf electric field were deduced from these comparisons. Then, the intensity, frequency, and structure of the instabilities arising in the plasma were studied. They depend on the electron temperature. It was shown that the plasma can maintain either ionic oscillations or pseudo-acoustic waves and drift waves when the discharge takes place in a magnetic induction. These waves can be excited by currents of electrons oscillating in the hf field and drifting in the plasma.
NSA

N70-33118# Uppsala Univ. (Sweden). Inst. of Physics.
STUDIES OF EQUATIONS DESCRIBING EXPLOSIVE INSTABILITIES
Jan Weiland Nov. 1969 11 p refs
(UUIP-667) Avail: AEC Depository Libraries

A set of equations describing three wave interaction in plasmas is solved numerically for different limiting cases. Functions approximately describing the time-development of the amplitudes and the phase psi are given. In the case phi(t) = phi sub 0 where psi sub 0 is a constant, the equations are solved exactly if the linear damping is identical for the three modes. For initial values deviating slightly from those which yield phi(t) = phi sub 0 the equations are solved by means of a perturbation analysis.
Author (NSA)

N70-33122*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LINE BROADENING OF THE TRIPLET DIFFUSE SERIES OF HELIUM IN AN ARC-JET PLASMA
Carl Douglas Scott (Ph.D. Thesis—Texas Univ., Austin) Jul. 1970 122 p refs
(NASA-TM-X-58050) Avail: CFSTI CSCL 20I

Established spectroscopic techniques were used to determine the electron density and temperature in a helium arc-jet plasma. The measured parameters were used to calculate the Stark broadening of spectral lines in the triplet-diffuse series of helium. These calculations were made by use of the quasistatic approximation for ions and electrons, and were compared with measured profiles in a plasma where the center-line electron density 1.4 x 10 to the 15th power + or − 13% per cu cm and the center-line temperature was 7800 + or − 17% K.
Author

N70-33134# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
TURBULENT HEATING OF A PLASMA BY MEANS OF MICROWAVE SCATTERING Annual Progress Report, 1 Apr. 1969 - 31 Mar. 1970
31 Mar. 1970 15 p refs
(Contract AT(30-1)-3958)
(CU-3958-3) Avail: CFSTI

The experimental apparatus is described. The plasma is generated in two conical pinch guns and is injected along the hexapole guide fields simultaneously into each end of the static magnetic mirror field. The plasma density, before turbulent heating, can be set at 10 to the 12th power to the 13th power/cu cm by varying the injection conditions. Diagnostic instruments and results are described.
NSA

N70-33137# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LOW-FREQUENCY ECHO OSCILLATIONS IN NONEQUILIBRIUM PLASMA
V. N. Pavlenko 1969 11 p refs In RUSSIAN
(ITF-69-93) Avail: AEC Depository Libraries

The effects of temporary and spatial echo in nonisothermal nonequilibrium plasma penetrated by a compensated beam of charged particles of small density are considered. It is shown that, with the excitation of two intensely damped short-wave oscillations, the long-wave echo oscillations can appear on the frequency of nonisothermal sound. The growth of the appearing low-frequency oscillations in time is investigated for the case of temporary echo and strengthening in space in the case of spatial echo.
Author (NSA)

N70-33157# Commissariat a l'Energie Atomique, Villeneuve-Saint-Georges (France).
LIGHT SCATTERING FROM THE PLASMA OF THE FOCUS MACHINE [DIFFUSION DE LA LUMIERE PAR LE PLASMA DE LA MACHINE FOCUS]
J. P. Baconnet, G. Cesari, A. Coudeville, and J. P. Watteau 1969 8 p In FRENCH Presented at Discussions of the Diagnostic Group of Plasmas, Fontenay-aux-Roses, France, 29-30 Aug. 1969
(CEA-CONF-1344; CONF-690431-1) Avail: AEC Depository Libraries

The scattering of a monochromatic light wave from a ruby laser by the electrons of a deuterium plasma was measured. The results were analyzed by a least squares method in an attempt to find the best theoretical spectral profile corresponding to the experimental points. This gives the ion temperature of the plasma which varies according to the case.
NSA

N70-33215# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
EXPERIMENTS ON CHARGE EXCHANGE OF FAST PLASMA

CLUSTERS IN THE INES DEVICE
L. V. Zamarashkin, K. B. Kartashev, V. I. Pistunovich, V. V. Platonov, and E. A. Filimonova 1970 48 p refs In RUSSIAN
(IAE-1951) Avail: AEC Depository Libraries

The possibility of obtaining a dense beam of hydrogen atoms with particle energies above 1 keV by means of charge exchange in a magnesium vapor target from plasma clusters generated by a coaxial plasma gun is investigated. It is shown that the charge exchange takes place in agreement with a pair collisions model for incident beam densities and the target efficiently removes particles with energies lower than 1 keV from the beam. NSA

N70-33232*# Scientific Translation Service, Santa Barbara, Calif.
ON THE QUESTION OF EFFICIENT EXTRACTION OF ELECTRONS FROM A PLASMA IN A VACUUM [K VOPROSU OB EFFEKTIVNOM OTBORE ELEKTRONOV IZ PLAZMY V VAKUUM]
Yu. Ye. Kreyndel et al Washington NASA May 1970 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 9, 1969 p 151–153
(Contract NASw-2035)
(NASA-TT-F-12978) Avail: CFSTI CSCL 20I

It was found that the Penning discharge with a cold cathode as an auxiliary discharge in a plasmatron extends the capabilities of this type of device. The deformation of the transverse magnetic field helps to reduce the operating pressure and increase the electron current. Author

N70-33246# United Aircraft Corp., East Hartford, Conn. Research Labs.
PRODUCTION OF PLASMAS FOR THERMONUCLEAR RESEARCH BY LASER BEAM IRRADIATION OF SOLID PARTICLES Semiannual Report, 1 Jan.–31 Jul. 1969
Alan F. Haught, Donald H. Polk, James C. Woo, and Walter J. Feder 31 Jul. 1969 89 p refs
(Contract AT(30-1)-3578)
(NYO-3578-11; UARL-H-920365-11) Avail: CFSTI

An experimental and theoretical investigation was made of the production of high-temperature, high-density, spherically expanding free plasmas and the interaction of these plasmas with magnetic containment fields of mirror and minimum-B geometry. The plasmas in these experiments are produced at the center of the magnetic containment field by irradiation of an electrically suspended, micron-sized solid particle with the focused beam of a Q-switched laser. Hydrodynamic and simplified integrated similarity models of the free plasma formation and development have been developed and give results for the plasma energy in good greement with experimental measurements. Theoretical studies using the hydrodynamic model have examined the early plasma-magnetic field interaction and show plasma deceleration, trapping and thermalization within the confining magnetic fields. Experimental studies of the interaction of the initially spherical, expanding, laser-irradiated solid particle plasmas with magnetic confinement fields of mirror and minimum-B geometry at field strengths up to 8 kG confirm the results of these calculations. Author (NSA)

N70-33253# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ANNULAR SOURCE OF IONS OF THE MAGNETRON TYPE [SOURCE D'IONS ANNULAIRE DE TYPE MAGNETRON]
Andre Bariaud, Jean Druaux, and Francois Prevot [1969] 19 p refs In FRENCH Presented at the Intern. Conf. on Ion Sources, Saclay, France, 18-20 Jun. 1969
(CEA-CONF-1387; Conf-690625-3) Avail: AEC Depository Libraries

A 2.4-m annular ion source for the injection of H(+2) ions for the formation of a high-temperature plasma in a magnetic mirror configuration was constructed. The source is described and illustrated. Characteristics of the ion source were determined. The experimental device and the beam adjustment for injection of the ions at the center of the magnetic configuration are discussed. The intensity of the injected beam was 300 mA instead of the 700 mA expected. The reasons for this current reduction are summarized. The pumping system is described. NSA

N70-33267* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
PLASMA ACCELERATOR Patent
George P. Wood, Arlen F. Carter, and Adolf Busemann, inventors (to NASA) Issued 23 Feb. 1965 (filed 7 Mar. 1962) 5 p Cl. 315-111
(NASA-Case-XLA-00675; US-Patent-3,171,060; US-Patent-Appl-SN-178213) Avail: US Patent Office CSCL 20I

A linear, steady-flow, direct current crossed-field plasma accelerator is described for application in laboratory reproduction or simulation of atmospheric reentry conditions of velocity, temperature, and density to which space vehicles are exposed. The configuration of the accelerator effectively eliminates neutralization of positive ions through contact with the accelerator wall, which improved acceleration efficiency. R.B.

N70-33299*# Techtran Corp., Glen Burnie, Md.
BOUNDARY LAYER OF A DUAL TEMPERATURE PLASMA ON THE ELECTRODES OF A MAGNETO-HYDRODYNAMIC CHANNEL WITH LATTICE TYPE ELECTRIC AND MAGNETIC FIELDS AT HIGH VALUES OF THE HALL PARAMETER [POGRANICHNYY SLOY DVUKHTEMPERATURNOY PLAZMY NA ELEKTRODAKH MAGNITOGIDRODINAMICHESKOGO KANALA SO SKRESHCHENNYMI ELEKTRICHESKIM I MAGNITNYM POLYAMI PRI BOLSHIKH ZNACHENIYAKH PARAMETRA KHOLLA]
L. Ye. Kalikhman Washington NASA Jun. 1970 12 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, 1969 p 40–46
(Contract NASw-2037)
(NASA-TT-F-13007) Avail: CFSTI CSCL 20I

Existing works on the magnetohydrodynamics of the boundary layer are concerned with examination of isolated questions and simplified problems, with no complete system of equations for the boundary layer of a compressible magnetized two-temperature plasma on electrodes. Here these equations are developed, limited to an ionized quasineutral plasma at small Reynolds values. Author

N70-33316# Pennsylvania State Univ., University Park. Ionospheric Research Lab.
WAVE PROPAGATION PROPERTIES OF THE MOLECULAR ELECTRONIC PLASMA, PART 1
O. E. H. Rydbeck and A. Hjalmarsson 15 Jul. 1970 22 p refs
(Grant NSF GP-5611)
(SR-359) Avail: Issuing Activity

The basic wave propagation properties of the molecular electronic plasma at thermodynamic equilibrium are considered. One of the two constituents of the plasma is allowed to drift in the direction of propagation which is parallel to the static magnetic field of the system. A number of dispersion relation diagrams, for the lossless medium, are discussed with particular reference to the various mode coupling phenomena. New types of waves have been found for the drifting, molecular plasma. There are four modes in all, two forward ones, and two backward named molecular cyclotron waves. Author

N70-33358# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DYNAMICAL STABILIZATION OF A CONFINED PLASMA
A. Samain [1969] 4 p refs Presented at the 9th Intern. Conf.

on Phenomena in Ionized Gases, Bucharest, 31 Aug. –6 Sep. 1969 (CEA-CONF-1397; CONF-690803-28) Avail: AEC Depository Libraries

The stabilization of a magnetically confined plasma by an oscillating electromagnetic field was studied previously using microscopic equations. A formalism suitable to this type of study is presented in this paper for a collisionless low-beta plasma. NSA

N70-33363# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
CONVERSION OF A RADIALLY CONVERGENT BEAM WITH A LARGE DISPERSION OF ENERGY INTO A CYLINDRICAL BEAM [CONVERSION D'UN FAISCEAU RADIAL CONVERGENT A GRANDE DISPERSION D'ENERGIE EN UN FAISCEAU CYLINDRIQUE]
Rudolf Becherer and Francois Prevot 1969 12 p refs In FRENCH Presented at the Intern. Conf. on Ion Sources, Saclay, France, 18-20 Jun. 1969
(CEA-CONF-1386; Conf-690625-4) Avail: AEC Depository Libraries

For the formation of a very high temperature plasma by injection, capture, and accumulation of accelerated particles, a radial beam with large energy dispersion was transformed into an axially cylindrical beam. This beam from an annular ion source of the magnetron type was transformed with an aid of a deflection system with inhomogeneous electrostatic field. Calculations and experiments have shown that obtaining a convergent cylindrical beam is possible and depends critically on the injection condition for the beam in the deflection system. It is also necessary that the trajectories of the ions from the source do not have an azimuthal component. This condition necessitates a compensation of the self magnetic flux of the source. The compensation of the magnetic flux was calculated, developed, and experimented on. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-32041# Air Force Cambridge Research Labs., Bedford, Mass.
CHARACTERISTIC ENERGY ABSORPTION SPECTRA OF SOLIDS
Johannes N. Plendl Aug. 1969 85 p refs Presented at the European Congr. on Mol. Spectry. (9th), Madrid, 12 Sep. 1967
(AD-704551; AFCRL-PSRP-393; AFCRL-69-0353) Avail: CFSTI CSCL 20/12

A method was developed to derive the fundamental absorption spectra of solids directly from experimental infrared data without having to resort to computational evaluation. These characteristic lattice absorption spectra represent the true energy absorption spectra of solids and are, through Kirchhoffs Law, directly related to the emission spectra of solids. As opposed to the traditional absorption coefficient (k) versus frequency curve, which is regarded as the absorption spectrum for solids in the region of anomalous dispersion, the spectra, as derived by the proposed method, clearly resolve the transverse and longitudinal modes of vibration. They also exhibit the characteristics of anharmonicity and damping. The method uses the combined reflection and transmission data on single-crystal and thin-film specimens. Its validity has been verified on a wide variety of solids. The most recent data obtained from emission, laser-Raman, or cold neutron scattering techniques, is in complete agreement with the derived values. A method of calculating the various modes of vibration of solids, directly from elastic constants, is also advanced. The importance of these spectra is discussed with regard to problems in solid state physics (particularly damping characteristics, temperature effects, and nonlinear effects of atomic binding in solids). Author (TAB)

N70-32091# Air Force Cambridge Research Labs., Bedford, Mass.
ELECTRON OPTICAL STUDIES OF HETEROEPITAXIAL GROWTH OF BETA SILICON CARBIDE LAYERS THROUGH MOLTEN METAL INTERMEDIATES
Joseph J. Comer and Irvin Berman Mar. 1970 22 p refs
(AD-704550; AFCRL-PSRP-410; AFCRL-70-0130) Avail: CFSTI CSCL 20/12

Beta silicon carbide has the potential of becoming an important semiconductor device material for hazardous military environments such as high temperature and radiation. This report is concerned with a study of the growth of thin single crystal films of beta silicon carbide through molten metal intermediates. Thin films of nickel, cobalt, chromium and iron were deposited by vacuum deposition on to the (0001) faces of single crystals of alpha silicon carbide. Then heteroepitaxial layers of beta silicon carbide were deposited through the molten metal films by the hydrogen reduction of methyltrichlorosilane. The deposited films were studied by electron microscopy, electron diffraction and electron beam microprobe analysis to determine the growth mechanism and to arrive at optimum conditions for heteroepitaxial growth. From the results obtained it was concluded that nickel and cobalt were equally effective in promoting epitaxial growth. Films of nickel only 20A in thickness were as effective as those up to 300A. Results with chromium and iron were disappointing for different reasons. Chromium did not etch the substrate surface uniformly because of poor wetting. With iron, whisker growth of beta silicon carbide occurred at the surface. Although in many respects the growth of mechanism resembled that of the vapor-liquid-solid method, certain differences were observed which make the actual growth mechanism using nickel and cobalt films still uncertain. Author (TAB)

N70-32144*# Little (Arthur D.), Inc., Cambridge, Mass.
DIELECTRIC PROPERTIES OF BASALT POWDERS Final Report
1 Jun. 1970 17 p
(Contract NAS8-25119)
(NASA-CR-102770; Rept-71679) Avail: CFSTI CSCL 20L

Particle size and density effect on the dielectric constant and the loss tangent of basalt powders was investigated. Basalt powders were sized into three groups and packed to densities ranging from 0.6 to 1.5 gm/cu cm. Measurements of the attenuation of X and K band microwave radiation for each sample were made. The measurements were performed in a dry nitrogen environment at room temperature. The dielectric constants of the powders ranged from 1.6 to 3.3. The real part of the dielectric constant increased regularly with increasing density. There was no significant difference between the results of X band and K band measurements. The dielectric constant is independent of particle size. Measurements of loss tangent exhibited a considerable scatter and increased with increasing density. There did not seem to be any difference between the results for X and K band radiation, and there was no apparent effect of particle size on loss tangent. Author

N70-32460*# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
PHOTOEMISSION, PHOTOLUMINESCENCE AND PHOTOCONDUCTIVITY OF SOLIDS IN THE VACUUM ULTRAVIOLET REGION Final Report
William Pong May 1970 154 p refs
(Grant NGR-12-001-002)
(NASA-CR-110635) Avail: CFSTI CSCL 20L

The interaction of photons with gases and solids in the spectral region of 2000 to 500 A is reviewed. While the principal aim was to investigate the photoelectric properties of solids, the study of gases was included to provide a convenient secondary standard for absolute yield measurements below 1000 A. By comparing the ion current with the response of a calibrated thermocouple, the photoionization yield of xenon was found to be

unity in the region 800-1000 A. The spectral quantum yields of a number of photoemissive films, were measured. Photoemission from evaporated MgF2 in the region of exciton absorption was measured. In addition to the spectral-yield measurements, the escape length for photoelectrons in evaporated films such as CuBr, KBr, gold, and aluminum were estimated from the yield vs film-thickness data. Exciton-induced photoemission from evaporated KCl films was observed. The effect of biasing radiation (visible light) on the interaction between excitons and F-centers was investigated. Author

N70-32491# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS AND INSTRUMENTS FOR QUALITATIVE CONTROL OF RUBY CRYSTALS: SELECTED ARTICLES
S. V. Grum-Grzhimailo et al 14 Nov. 1969 114 p refs Transl. into ENGLISH from Rost Kristallov, Akad. Nauk SSSR (Moscow), v.8, 1968 p 5-41, 50-54, 59-65, 67-71, 78-101
(AD-701977; FTD-MT-24-293-69) Avail: CFSTI CSCL 20/2

Contents: Investigation of quality of crystals using ruby as an example: Exposure and investigation of dislocations in crystals by different methods; Determination of the concentration of Cr3(+) in rod crystals of ruby by absorption spectra; Methods of investigation of heterogeneity in indices of refraction of crystals; Orientation of crystals and investigation of their optical anomaly; Measurement of internal stresses in rod crystals of corundum; Determination of the value of mutual disorientation of blocks in crystals of ruby by the optical method; Differential calorimeter with thermal bridge for measurement of energy of a laser; and Instruments for measurement of pulsed light energy. TAB

N70-32505# Manlabs, Inc., Cambridge, Mass.
PHYSICAL CHARACTERIZATION OF ELECTRONIC MATERIALS, DEVICES AND THIN FILMS Final Report, 1 Dec. 1967 - 1 Dec. 1969
S. Andrew Kulin, Edward V. Clougherty, Edward T. Peters, and Konstantin Kreder Jan. 1970 43 p refs
(Contract F19628-67-C-0173)
(AD-703275; AFCRL-70-0050) Avail: CFSTI CSCL 20/12

Experimental methods include chemical analysis, reflection electron diffraction, X-ray diffraction and fluorescence analysis, light microscopy and electron probe microanalysis, in addition to the determination of specific properties, such as density, hardness and thermal conductivity. Special services such as crystal orientation, cutting, grinding and polishing, are also being performed. Specific materials submitted for characterization include spinel, cobalt, silicide, lithium germanate, silicon, mercury sulfide, cadmium sulfide, silicon carbide, quartz, ruby, calcite, magnesium oxide, cesium copper chloride, gallium arsenide, boron, potassium tantalum niobate, alundum, yttrium-iron garnet, yttrium-aluminum gasket, germanium and lithium niobate. In addition, a variety of specimens were submitted for specific studies such as phase identification, crystallinity and chemical analysis. High pressure experiments were carried out on Al-S and Al-Se alloys to produce tetrahedral, unsymmetrical Group IV analogs. Two new compounds, delta Al2S3 and delta Al2Se3, were synthesized at pressures of 7 to 50 Kb at temperatures of 800 to 875C. Both compounds have the cubic defect spinel structure of alpha Al2O3. The synthesis experiments pointed out the presence of tetrahedral-to-octahedral coordination densification transformations which compete with the high pressure synthesis of new tetrahedral Group IV analog compounds. Author (TAB)

N70-32516# Northwestern Univ., Evanston, Ill.
LATTICE ANISOTROPY IN ANTIFERROMAGNETIC CHROMIUM
M. O. Steinitz, L. H. Schwartz, J. A. Marcus, E. Fawcett (Bell Telephone Labs.), and W. A. Reed (Bell Telephone Labs.) 1970 7 p refs Sponsored in part by ARPA and NSF Prepared in cooperation with Bell Telephone Labs., Murray Hill, N.J.
(AD-704801) Avail: CFSTI CSCL 20/2

Thermal expansion and magnetostriction measurements on single-Q, single crystal chromium give the lattice parameter ratios in the transverse spin-density-wave phase, through the spin-flip transition, and in the longitudinal spin-density-wave phase. The spin-flip transition is found to be accompanied by anisotropic discontinuities in length, resulting in a net volume dilatation of 0.0000014 with decreasing temperature. The Q direction is found to be the longest axis at 300 degrees K and to become the shortest axis below about 220 degrees K. Author (TAB)

N70-32517# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
DEFECT GENERATION IN COPPER AND ALUMINUM DURING LOW TEMPERATURE ELECTRON IRRADIATION [DEFEKTAUFBAU IN KUPFER UND ALUMINIUM BEI TIEFTEMPERATUR-ELEKTRONEN-BESTRAHLUNG]
Wolfgang Sassin (Ph.D. Thesis—Tech. Hogeschule, Aachen) Apr. 1969 84 p refs In GERMAN
(Jul-586-FN) Avail: CFSTI

A step-like thermal recovery of mainly neighboring pairs of primary Frenkel defects and brief intervals of radiation tests established that by two different, low electron radiation caused recombination processes reduce measurable damage rate during defect generation in ultrapure copper and aluminum crystals. This susceptibility to low level recombinations is characteristic for certain pair configurations and decreases as thermal stability increases. Low level electron radiation pulses induced rearrangement, selective recombination, as well as the median distance between single Frenkel pairs in the defect pattern. The step 1 component in the isochronic thermal repair decreased in copper from 85 to 55 percent, and in aluminum from 80 to 45 percent mainly by reducing step 1D. The concurring formation of step 2 - not observed in ultrapure copper and aluminum at very low electron irradiation - was caused by interstitial lattice atoms and hole complex formations. Transl. by G.G.

N70-32563*# Honeywell, Inc., Lexington, Mass. Radiation Center.
STUDY FOR ADVANCED DEVELOPMENT OF 15-MICRON (Hg, Cd) Te DETECTORS
Harris Halpert and Toivo Koehler [1970] 87 p refs
(Contract NAS1-8996)
(NASA-CR-66954) Avail: CFSTI CSCL 20L

A study of 1/f noise to develop high performance 15-micron (Hg,Cd)Te detectors for slow scan operation is presented. Topics discussed, include characteristics, sources, and special fabrication and treatment techniques. The results indicate: (1) The contacts of 15-micron (Hg,Cd)Te are not a source of noise. (2) Slow surface states do not exist in (Hg,Cd)Te. (3) The Hall mobility in 15-micron material is related to carrier concentration. F.O.S.

N70-32567*# Illinois Univ., Urbana. Coordinated Science Lab.
INVESTIGATION OF THE LUMINESCENT PHENOMENA OF HIGH RESISTIVITY SILICON AND STUDY OF ELECTRICAL CHARACTERISTICS OF TUNNELING INTO LOW RESISTIVITY SILICON Annual Progress Report, 20 Sep. 1968 - 19 Sep. 1969
W. Dale Compton 15 Oct. 1969 27 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952383)
(NASA-CR-110720) Avail: CFSTI CSCL 20L

The development of two techniques to examine the properties of defects introduced into silicon by high energy particle irradiation is reported. These include the observation of the luminescence that occurs upon the recombination of electrons and holes at the defects and the influence of defects upon the tunneling of electrons from a metal into silicon. The measurements obtained demonstrate that the recombination luminescence is of great value in the study of defects that introduce energy levels deep in the forbidden gap.

It was used to provide information on the influence of impurities, such as oxygen and lithium, upon the defect structure, on the symmetry of the defects and the changes in the defects that result from the thermal annealing of irradiated samples. The experiments on electron tunneling concentrated upon achieving an understanding of the characteristics of tunneling in non-irradiated materials. These results indicate that there exists a dopant region for which tunneling takes place with the assistance of intermediate states arising from defects or impurities. These techniques appear to be useful for the examination of defects introduced into the barrier by radiation. Author

N70-32720# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
THE EFFECTS OF ELECTRIC AND MAGNETIC FIELDS ON THE NUCLEATION, STRUCTURE, AND RESIDUAL PROPERTIES OF VAPOR DEPOSITED METAL FILMS Annual Progress Report
Lawrence E. Murr Dec. 1969 9 p refs
(Contract AT(11-1)-113)
(USC-113-P-22-1; USCEE-382) Avail: CFSTI

Preliminary design and fabrication of ultra-high vacuum evaporation control systems is outlined, and the general design features of a special ultra-high vacuum unit for the nucleation of metal vapor under the influence of electric or magnetic fields are described. Calibration of the magnetic field capability has indicated a linear field intensity with input coil current, with a magnetic field of 2 kilogauss obtained for a coil current of approximately 7 amperes. Author (NSA)

N70-32741# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALL-UNION CONFERENCE ON THE PHYSICAL PROPERTIES OF SEMICONDUCTORS, GROUPS 3A-5A AND 3A-6A
I. V. Kryukova et al 6 Feb. 1970 20 p refs Transl. into ENGLISH from the Russian Conf. held at Baku, 1965
(AD-703551; FTD-MT-24-359-69) Avail: CFSTI CSCL 20/12

Contents: Investigation of certain optical and electroluminescent properties of solid GaAs-InAs solutions. Effects of transfer in strongly alloyed antimonide crystals of the indium p-type. Electrical properties of alloyed gallium phosphide crystals. TAB

N70-32938*# Westinghouse Electric Corp., Pittsburgh, Pa. Electronics Research Center.
RESEARCH AND DEVELOPMENT STUDY ON WIDE BAND-GAP SEMICONDUCTOR FILMS Final Report, Dec. 1968 - Dec. 1969
A. J. Noreika, M. H. Francombe, and S. A. Zeitman Dec. 1969 185 p refs
(Contract NAS12-568)
(NASA-CR-86398) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 20L

Thin films of AlSb, AlAs and AlP have been prepared by a three-temperature reactive evaporation technique, while films of AlN, Bn and of two mixed nitrides, viz., (Al,Si) N and (Al,B) N, were deposited using a reactive sputtering method. Reactive sputtering was also used to produce films of AlSb. The structural, optical and electrical properties of these films were examined and related to conditions of deposition. The properties were compared with published data for these materials in (where available) thin film, or alternatively bulk, single-crystal form. Since AlN is known to exhibit piezoelectric behavior, thin film transducer structures of this nitride were also prepared and evaluated. Author

N70-32941# Utah Univ., Salt Lake City.
THERMAL CONVERSION OF INTERSTITIALS
H. M. Simpson and A. Sosin [1969] 11 p refs Sponsored by AEC
(COO-1800-8) Avail: CFSTI

The observations of Thompson and Buck (Phys. Status Solidi, to be published) on dislocation pinning in gamma-irradiated Cu are summarized. The model proposed by Bauer et al., in which interstitials are the mobile Stage 1 defect and undergo thermal conversion to immobile Stage 3 defects, is shown to be reasonable. The Stage 1 defect is visualized as an interstitial with axis along the (3) direction and capable of three-dimensional diffusion; the Stage 3 defect is the (100)-oriented interstitial (dumbbell). Equations are derived for the pinning rate in this model, and the impurity trapping term is shown to be responsible for the wide range of pinning rates (factor of 100,000) between 80 and 400 K. Excellent agreement with the data of Thompson and Buck is found. NSA

N70-33016# Naval Postgraduate School, Monterey, Calif.
CALORIMETRIC INVESTIGATION OF THE ANTIFERROMAGNETIC TRANSITION IN NiCl2-6H20
William Lewis Johnson (Ph.D. Thesis) Dec. 1969 107 p refs
(AD-704072) Avail: CFSTI CSCL 20/12

The results of measurements of the specific heat of nickel chloride hexahydrate in zero and various applied fields are presented. The specific heats of two single-crystal samples were determined in zero field between 4.3 and 5.8 K with temperature resolution of 10 to the -6th K. The functional form of the specific heat near the Neel temperature was determined and compared with theoretical predictions. The specific heat maximum of both crystals is found to be rounded over several millidegrees. The effect of magnetic fields applied along the easy axis on the specific heat peak was investigated. The peak was found to be slightly broadened by the field, and occurred at lower temperatures. The boundary between antiferromagnetic and paramagnetic phases was determined for fields to 20 kilo-oersteds. Author (TAB)

N70-33245# Universidad Nacional Autonoma de Mexico, Villa Obregon. Facultad de Ciencias.
DEVELOPMENT OF LITHIUM-ACTIVATED GERMANIUM SEMICONDUCTOR NUCLEAR DETECTORS
Raul Gallardo Villegas (Ph.D. Thesis) 1970 72 p refs In SPANISH
(NP-18180) Avail: AEC Depository Libraries

The construction of coplanar lithium-drifted germanium detectors is presented. The interaction of nuclear radiation with matter, which is necessary in order to understand the functioning of semiconductors, is discussed. The properties and the theory of semiconductors necessary for detectors and the properties of the diffusion mechanism used to obtain ions in an n-p junction are considered. The operation and some uses of various types of detectors are treated in a general form, and the advantages and disadvantages of Li-drifted Ge detectors are given. The technique used in the construction of Ge(Li) detectors is presented, and the results obtained in the manufacture of these detectors are given. Author (NSA)

N70-33395# National Research Council of Canada, Ottawa (Ontario).
INVESTIGATION OF THE RISE AND DECAY OF LUMINESCENCE OF ORGANIC MOLECULAR CRYSTALS [UNTERSUCHUNGEN ZUM PROBLEM DES AN- UND ABKLINGENS DER LUMINESZENZ ORGANISCHER MOLEKUELKRISTALLE]
K. Kramer 1970 28 p refs Transl. into ENGLISH from Z. Naturforsch. (Tuebingen), 22a, 1967 p 1108-1120
(NRC-TT-1405) Avail: CFSTI

The theoretical background of the time behavior of the luminescence of organic molecular crystals is discussed briefly and equipment for measuring the rise and the decay of luminescence intensities over four decades is described. Results on single crystals of anthracene, pyrene, 2,3-dimethyl napthalene, and mixed crystals at 77 K and 300 K are reported and conclusions are drawn regarding the luminescence mechanism in mixed crystals. Some methods of measuring luminescence decay times are compared. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-32279*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 191–212 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 21I

Heat transfer and combustion termination of solid propellants, and performance analysis of propulsion systems are discussed. A mathematical model is developed for heat transfer in a burning solid propellant with oscillating surface temperature and surface regression. A test program is described for studying the combustion termination of a solid propellant by rapid depressurization. A theoretical performance analysis is outlined for propulsion systems for outer-planetary orbits. N.E.N.

N70-32282*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID PROPULSION: MATERIAL COMPATIBILITY
O. F. Keller and L. R. Toth *In its* Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 250–251 (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 21I

The effects of long term storage of earth storable propellants with construction materials were studied. The propellants were hydrazine, monomethyl hydrazine, hydrazine/hydrazine nitrate mix, and inhibited nitrogen tetroxide. The automatic data processing is briefly described. N.E.N.

N70-32464*# Rocketdyne, Canoga Park, Calif.
CHAMBER TECHNOLOGY FOR SPACE STORABLE PROPELLANTS Final Report, Jun. 1964–Sep. 1969
Sep. 1969 112 p refs
(Contract NAS7-304)
(NASA-CR-110644; R-7998) Avail: CFSTI CSCL 21I

Chamber technology for several space storable propellant combinations featuring oxygen difluoride (OF2) oxidizer is reviewed. The fuels evaluated for combination with OF2 were monomethylhydrazine (MMH), butene-1 (C4H8) and diborane (B2H6). Extensive design criteria were developed for OF2/MMH; performance and heat transfer criteria were developed for OF2/B2H6 and OF2/C4H8. A full analysis technique was derived for rational selection of optimum fuels for combination with OF2. Selection of the candidate fuels was based on performance, operational aspects, and compatibility for thrust chamber cooling. Areas of investigation included injector performance, performance demonstration under simulated altitude conditions for OF2/MMH, and throttling characteristics for all of the propellant combinations. Complete assessment of heat transfer characteristics were conducted for each propellant system. Design criteria were generated for either regenerative or ablative cooling with OF2/MMH. Passive cooling technology was also developed for OF2/B2H6; however, the OF2/C4H8 studies were limited to heat transfer characterization. Author

N70-32554# Aberdeen Proving Ground, Md. Coating and Chemical Lab.
INVESTIGATING THE ELASTOMER ENVIRONMENTAL EFFECTS ON THE STORAGE STABILITY OF MILITARY FUELS Final Report
Maurice E. Lepera Apr. 1970 27 p refs
(AD-704707; CCL-279) Avail: CFSTI CSCL 13/4

The elastomer environmental effects of collapsible fuel containers on the product quality of military fuels was evaluated under conditions of static storage testing. Collapsible 500-gallon fuel drums were evaluated using six fuels common to military fuel supply systems. To permit a meaningful assessment of the extent and origin of fuel degradation, control containers were concurrently evaluated to account for naturally-occurring auto-oxidation of the fuels under test. Using specification limits as fail criteria, four of the six fuel types under test gave evidence of contamination resulting to elastomer-fuel interactions. Author (TAB)

N70-32912*# Martin Marietta Corp., Denver, Colo.
EXPERIMENTAL INVESTIGATION OF CAPILLARY PROPELLANT CONTROL DEVICES FOR LOW GRAVITY ENVIRONMENTS, VOLUME 1 Summary Report, 26 Jun. 1967–30 Jun. 1970
Jun. 1970 47 p refs
(Contracts NAS8-21259; NAS8-20837)
(NASA-CR-110754; MCR-69-585-Vol-1) Avail: CFSTI CSCL 21I

An experimental program was conducted in Martin Marietta's 2.1 sec drop tower to collect and verify criteria needed to design capillary systems to provide orientation and control liquid propellant during low g accelerations. More than 300 drop tests were made under controllable and repeatable near constant accelerations applied normal and parallel to flat perforated plates and screens to evaluate liquid/gas interface stability and liquid damping criteria. The ability of annuli formed by screens to refill by capillary pumping was also studied. Test liquids were Freon-TF, carbon tetrachloride, chloroform, and methanol. The test results and dimensionless parameters presented are applicable to the design of capillary systems that rely only upon surface tension and system pressure to control liquid propellants during coasting phases of space missions. Author

N70-32913*# Martin Marietta Corp., Denver, Colo.
EXPERIMENTAL INVESTIGATION OF CAPILLARY PROPELLANT CONTROL DEVICES FOR LOW GRAVITY ENVIRONMENTS, VOLUME 2 Final Report, 26 Jun. 1967–30 Jun. 1970
George E. Alexander, Thomas R. Barksdale, Ralph E. Hise, Kingsley C. Lunden, and Howard L. Paynter Jun. 1970 150 p refs
(Contracts NAS8-21259; NAS8-20837)
(NASA-CR-110755; MCR-69-585-Vol-2) Avail: CFSTI CSCL 21I

For abstract see N70-32912.

N70-33220*# Rocketdyne, Canoga Park, Calif. Advanced Systems.
FLUORINE-HYDROGEN PERFORMANCE EVALUATION PHASE 2-SPACE STORABLE PROPELLANT PERFORMANCE DEMONSTRATION Final Report
B. J. Waldman Apr. 1969 251 p refs
(Contract NASw-1229)
(NASA-CR-72542; R-6636-3) Avail: CFSTI CSCL 21I

Work performed under Phase II of the Fluorine/Hydrogen Performance Evaluation Program is reported. During this phase of the program, the propellants were tested in an altitude-simulation facility using two high-area-ratio nozzles and one low-area-ratio nozzle. Performance and heat transfer data were recorded, analyzed and compared with analytical predictions. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-32011*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT DATA PROCESSING ON THE SEPR HM4 LIQUID OXYGEN AND HYDROGEN MOTOR [TRAITEMENT DES MESURES EFFECTUEES SUR LE MOTEUR SEPR HM4 A OXYGENE ET HYDROGENE LIQUIDES]
B. Mercier Jul. 1970 21 p Transl. into ENGLISH from Bull., Assoc. Tech., Maritime et Aeron. (France), v. 69, 1969 p 169–181
(NASA-TT-F-13127) Avail: CFSTI CSCL 21H

Systems for measurement data processing in developing a liquid oxygen and liquid hydrogen rocket engine with a thrust of 40 kN are presented. The numerical measuring system is described. Author

N70-32047*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF AN AUXILIARY INLET EJECTOR NOZZLE WITH FIXED INLET DOORS AND TRIPLE-HINGE TRAILING-EDGE FLAP
Albert L. Johns and Fred W. Steffen Washington Jul. 1970 68 p refs
(NASA-TM-X-2034; E-5497) Avail: CFSTI CSCL 21H

An auxiliary inlet ejector nozzle appropriate for a supersonic-cruise aircraft was evaluated over a range of free-stream Mach numbers from 0 to 1.20. Two primary throat areas were used: one to simulate nonreheat operation, and the other for reheat operation. The shroud was fixed in a closed position for subsonic operation. The projected boattail area was 47 percent of the simulated nacelle area. Variation in auxiliary inlets included door type (single and double hinge) and values of tertiary flow area (controlled with fixed-position doors) from 0 to 71.5 percent of the shroud exit area. During subsonic cruise and dry acceleration, the maximum nozzle efficiency was obtained with the double-hinge door configuration. At the reheat power settings, the maximum nozzle efficiency was obtained with the doors closed at Mach 0.60 and higher. Author

N70-32229*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
IN THE DEPTHS OF THE GALAXY
in its Goals and Means in the Conquest of Space May 1970 p 116–155 refs (See N70-32226 17-30)
Avail: CFSTI CSCL 22B

The problems of constructing an engine to propel a spacecraft to another galaxy and the difficulties of radio communication between a satellite and earth are reviewed. The search for intelligent life forms on other planets is also discussed. J.A.M.

N70-32246# Naval Air Propulsion Test Center, Trenton, N.J. Aeronautical Turbine Dept.
PERFORMANCE ANALYSIS OF A ROTARY NOZZLE UTILIZING A 30 DEG SPIN ANGLE ROTOR
Lawrence J. Palcza Apr. 1970 21 p refs
(AD-705057; NAPTC-ATD-184) Avail: CFSTI CSCL 21/5

Static thrust augmentation experiments have been performed with a rotary nozzle induction device to determine the effect of a large spin angle on performance. A 30 deg spin angle rotor with a shroud area to primary nozzle exit area ratio of 19.6 was tested over a primary to secondary pressure range of 1.2 to 1.8 at a primary-secondary temperature ratio of 1.0. Author (TAB)

N70-32385# Douglas Aircraft Co., Long Beach, Calif.
A STUDY OF THE COMPATIBILITY OF A FOUR ENGINE COMMERCIAL JET TRANSPORT AIRCRAFT FUEL SYSTEM WITH GELLED AND EMULSIFIED FUELS Final Report
A. T. Peacock, R. F. Hazelton, L. S. Gresko, and L. D. Christensen Apr. 1970 193 p refs
(Contract FA-68-NF-273)
(NA-70-11; DS-70-1) Avail: CFSTI

The rheological and physical properties of four gelled and three emulsified turbine fuels were evaluated. One gelled and one emulsified fuel were selected for further test and analysis in a compatibility study with a four engine commercial jet transport aircraft fuel system. Full scale testing of system components was performed. Penalties and problem areas associated with using the fuels were identified by an analysis of the fuel system. A full-scale ground test program to evaluate an aircraft fuel system's performance on thickened fuels was outlined. Results show significant decreases in available fuel and large increases in system weights are associated with the use of the thickened fuels described. Substantial fuel development is indicated before application to commercial aircraft. Author

N70-32420# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENT IN EXPERIMENTAL ADJUSTMENT OF GAS TURBINE ASSEMBLY GT-6-750 TMZ ON PLANT STAND
M. M. Kovalevskii 24 Sep. 1969 20 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), No. 11, 1965 p 40–44
(AD-701986; FTD-MT-24-146-69) Avail: CFSTI CSCL 21/5

A description is given on basic stages and results of finishing bench tests of a pilot model of gas turbine plant GT-6-750. Author (TAB)

N70-32490# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MATCHING COMPRESSORS AND TURBINE PARAMETERS IN GAS TURBINE AIRCRAFT ENGINES
K. V. Kholshchevnikov 2 Dec. 1969 207 p refs Transl. into ENGLISH of the book "Soglasovanie Parametroy Kompressora i Turbiny Aviatsionnykh Gazoturbinnykh Dvigatelyakh" Moscow, Izv-Vo Mash Nostr., 1965 p 1–200
(AD-701978; FTD-HT-23-637-68) Avail: CFSTI CSCL 21/5

Contents: Turbojet engine with a single-spool axial compressor; Turbojet engine with a axial twin-spool compressor; Turbojet engine with centrifugal compressor; Bypass turbojet engine; The turbo-prop engine; and Closed-circuit gas-turbine plants. TAB

N70-32497*# Aerojet Liquid Rocket Co., Sacramento, Calif. Engineering Operations.
ACOUSTIC LINER FEASIBILITY PROGRAM Final Report, 19 Nov. 1968–19 Apr. 1970
15 Jun. 1970 328 p refs
(Contract NAS9-8852)
(NASA-CR-108511; Rept-8852-FR) Avail: CFSTI CSCL 21H

An evaluation of ablative materials for an acoustic resonator in an ablative chamber is discussed. The design and testing of one precharred and one cooled copper ablative acoustic resonator, both of which successfully withstood total durations in excess of 600 seconds, are described. The design and testing of an uncooled chamber with copper inserts used to obtain heat transfer data and cavity gas samples for evaluation of acoustic liner geometric variables and gas composition are also considered. Author

N70-32721*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ACOUSTIC AND AERODYNAMIC PERFORMANCE OF A 6-FOOT-DIAMETER FAN FOR TURBOFAN ENGINES. 1: DESIGN OF FACILITY AND QF-1 FAN
Bruce R. Leonard, Ralph F. Schmiedlin, Edward G. Stakolich, and Harvey E. Neumann Washington Jul. 1970 32 p refs
(NASA-TN-D-5877; E-5594) Avail: CFSTI CSCL 21E

A ground test facility was designed and built for conducting acoustic research on full-scale prototype fans to obtain fundamental fan noise information and to establish design technology for development of subsonic aircraft engines which will produce a minimum of noise. The objectives, design features, and instrumentation of the test facility are discussed and the design is described of the first model to be tested; a 72-inch diameter, 1.5-pressure-ratio fan operating over 60 to 90 percent of its cruise design corrected speed of 3533 rpm. Author

N70-32814*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN CONSIDERATIONS AND REQUIREMENTS FOR INTEGRATING AN ELECTRIC PROPULSION SYSTEM INTO THE SERT 2 AND FUTURE SPACECRAFT
Raymond J. Rulis [1970] 16 p refs Proposed for Presentation at the 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970; Sponsored by AIAA
(NASA-TM-X-52853) Avail: CFSTI CSCL 21C

Integration of a new propulsion system into a spacecraft requires establishing design criteria for interface control. Problems encountered during the integration of an electric propulsion system are delineated in the SERT spacecraft. Design criteria are established for future applications for high voltage handling, thruster breakdown, thrust vector control, and mechanical, thermal and electrical interfaces. Design considerations based on results from experiments aboard the SERT 2 spacecraft are discussed. Testing philosophy is presented for achieving long system life times on-orbit. Ground support equipment for propulsion system and integrated spacecraft testing during launch base activities is delineated. Author

N70-32841*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPONENT TESTING OF A 30-CENTIMETER DIAMETER ELECTRON BOMBARDMENT THRUSTER
Robert T. Bechtel [1970] 21 p refs Proposed for Presentation at the 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970; Sponsored by AIAA
(NASA-TM-X-52849) Avail: CFSTI CSCL 21C

A program to determine the effect of three critical components on mercury electron-bombardment thruster performance is described. Various glass-coated accelerator grids, hollow cathode configurations, and plasma bridge neutralizer positions were tested with a 30-centimeter diameter mercury thruster. The grid with the smallest diameter accelerator hole was found to provide the maximum beam current, highest propellant utilization efficiency, and most stable operation. Cathodes with orifices about 0.8 mm diameter provided the best thruster performance consistent with long life-time requirements. A neutralizer position pointing downstream at a 80° angle to the plane of the accelerator minimized the accelerator drain current. Author

N70-32843*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INITIAL PERFORMANCE DATA ON A LOW-POWER MPD ARC THRUSTER WITH A DOWNSTREAM CATHODE
James A. Burkhart [1970] 17 p refs Proposed for Presentation at the 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970; Sponsored by AIAA
(NASA-TM-X-52857) Avail: CFSTI CSCL 21C

Substantial improvement in the thrust performance of a low-power MPD arc thruster has been achieved in the specific impulse range of 600 to 2100 seconds. The thruster tested utilizes a cathode positioned in the exhaust beam, downstream of the anode, as opposed to the conventional position upstream of the anode. Xenon is the propellant used and testing is conducted in a background pressure of 1.6×0100001 torr. Operation achieved in the above specific impulse range is at thrust levels from 6 to 16 mN, power levels of 180 to 720 watts, and thrust efficiencies of 13 to 24 percent. Author

N70-32853*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 1000 HOUR ENDURANCE TEST OF A GLASS-COATED ACCELERATOR GRID ON A 15-CENTIMETER-DIAMETER KAUFMAN THRUSTER
Bruce A. Banks and Robert T. Bechtel Washington Jul. 1970 52 p refs
(NASA-TN-D-5891; E-5393) Avail: CFSTI CSCL 21C

A dished, glass coated, molybdenum, accelerator grid was operated for 1000 hours on a 15-cm-diameter Kaufman mercury thruster. Grid lifetime estimates based on grid weight loss, glass erosion, and molybdenum erosion were made after 508 hours of operation at an average net accelerating potential of 990 V and at an average ion beam current of 373 mA. Grid-edge termination schemes tested during the last 492 hours of the test indicate that the outermost holes and edge of the grid should be shadow shielded from the discharge chamber plasma and sputtered material. Author

N70-32891*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLASMA PROPERTIES AND PERFORMANCE OF MERCURY ION THRUSTERS
T. D. Masek 15 Jun. 1970 36 p refs
(Contract NAS7-100)
(NASA-CR-110731; JPL-TR-32-1483) Avail: CFSTI CSCL 21C

Langmuir probe measurements in conventional 15- and 20-cm-diameter thrusters using mercury are presented. The 15-cm-diameter thruster, of 1962 vintage, was operated at high flow-rates (650 mA equivalent mercury flowrate) for comparison with previous lower flowrate data and to establish reference thruster plasma characteristics. Measurements made in an improved 20-cm-diameter thruster are used to show the effects of operating conditions on the plasma and for comparison with the reference thruster characteristics. A modified form of the Bohm stable sheath criterion is shown to apply for computing ion fluxes. The use of this criterion, along with calculations of ion production rates and electron fluxes, permits a more accurate and comprehensive picture of discharge losses than has been obtained previously. Author

N70-32895*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EVALUATION OF RANGE AND DISTRIBUTION TOLERANCE FOR HIGH MACH NUMBER TRANSONIC STAGES
V. L. Doyle and C. C. Koch 23 Jul. 1970 124 p refs
(Contract NAS3-11157)
(NASA-CR-72720; GE-R70-AEG-223) Avail: CFSTI CSCL 21E

Two transonic single-stage compressors were designed to investigate the efficiency, weight flow range, and distortion tolerance of high-tip-speed fan stages and to determine the ability of variable-geometry blading to improve off-design performance. The first compressor, the Task I Stage, used an existing 1400 ft/sec-tip-speed, multiple-circular-arc rotor and a new matching stator. The Task II Stage consisted of a variable-camber inlet guide vane, a 1500-ft/sec-tip-speed rotor and a variable-stagger stator. Both stages had a rotor inlet tip diameter of 36.5 inches and a rotor inlet hub: tip radius ratio of 0.5. Both stages used the same stator vanes, had identical flowpaths, and used many of the same test vehicle components. The Task I Stage design total-pressure ratio was 1.817 at a weight flow of 219.4 lbs/sec; the Task II Stage design total-pressure ratio was 1.659 at a weight flow of 226 lbs/sec. Author

N70-32945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC INVESTIGATION OF MERCURY HOLLOW CATHODE NEUTRALIZERS
D. C. Byers and Aaron Snyder [1970] 20 p refs Proposed for presentation at the 8th Elec. Propulsion Conf., Stanford, Calif.,

31 Aug.–2 Sep. 1970; Sponsored by AIAA
(NASA-TM-X-52835) Avail: CFSTI CSCL 21C

A parametric investigation of mercury hollow cathode neutralizers for Kaufman ion thrusters was carried out in a bell jar over a range of collector (ion beam simulator) currents up to 2 A. The parameters investigated included mercury neutral flow rate, neutralizer cathode geometry, collector geometry and spacing, keeper power supply impedance, keeper current, keeper electrode geometry and spacing. Agreement was found between neutralizer operation in the bell jar and on an active thruster. The influence of the various parameters on neutralizer performance and control characteristics is discussed for three distinct modes of neutralizer operation. Author

N70-32985# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DESIGN OF ELEMENTS OF COMPONENTS AND SUBASSEMBLIES OF AIRCRAFT ENGINES
Yu. M. Nikitin 21 Jan. 1970 418 p refs Transl. into ENGLISH of the book 'Konstruirovanie Elementov Detaley i Uzlov Aviadigateley' Moscow, Izd-Vo Mashinostroyeniye, 1968 p 1–324
(AD-704730; FTD-MT-24-434-69) Avail: CFSTI CSCL 21/5

This is a textbook for course work and diploma projects in the field of aircraft engine building. It can also be used by students in institutes of higher education and technical schools of other machine building specialties, as well as by engineering and technical personnel working in the field of aircraft engine building and gas turbine building. The various design solutions used in the design of aircraft engine parts and units are examined. In each chapter are discussed the general requirements on the examined design elements, and recommendations are given on the basis of experience gained in industry. After an over all evaluation of the given design procedure, actual examples are given of various solutions of some problem taken from the practice of aircraft engine building. Based on examples of the design of several units of gas turbine engines, the relationship is shown between the design solutions for separate elements of the unit according to the technical requirements the accepted and design scheme of a unit and an engine as a whole. Author (TAB)

N70-33055*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EARLY APPLICATION OF SOLAR-ELECTRIC PROPULSION TO A 1-ASTRONOMICAL-UNIT OUT-OF-THE-ECLIPTIC MISSION
William C. Strack and Frank J. Hrach [1970] 19 p refs Proposed for presentation at the 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970; Sponsored by AIAA
(NASA-TM-X-52818) Avail: CFSTI CSCL 21C

Solar-electric propulsion is evaluated for an early application to an out-of-the ecliptic mission. Relatively short flight times are used to assess the performance of hardware. The electric propulsion system specific mass is assumed to be 30 kilograms per kilowatt and current thruster system efficiencies are employed. Two currently available launch vehicles are assumed: Atlas/Centaur and Titan IIIC. The results show that a negligible performance loss is incurred by using the simple constant-radius thrust control program compared with the more complicated variable-radius case. Also, a fixed design spacecraft with 10 kilowatts of electric power and 2600 seconds specific impulse can deliver nearly as much payload to a given heliographic inclination as an entire family of designs with optimum values of power and specific impulse. This holds true for both launch vehicles. Author

N70-33058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXHAUST CHARACTERISTICS OF A MEGAWATT NITROGEN MPD-ARC THRUSTER
Charles J. Michels and Donald R. Sigman [1970] 12 p refs Proposed for presentation at the 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970; Sponsored by AIAA
(NASA-TM-X-52855) Avail: CFSTI CSCL 21C

The number density (n sub e) electron temperature (T sub e), and velocity of the exhaust of a single pulse thruster were experimentally determined for various applied axial magnetic fields (0, 1.0, and 2.0 T). At an axial station 0.2 m from the anode, the no-field exhaust profile is approximately constant up to 4.0 cm from the centerline at a radius of 2 cm. Corresponding velocities were measured and are discussed. Author

N70-33104*# Aerojet Liquid Rocket Co., Sacramento, Calif. Dept. of Engine Components.
HEAT PIPE TECHNOLOGY FOR ADVANCED ROCKET THRUST CHAMBERS Interim Report, 3 Jan. 1969–2 May 1970
D. C. Rousar 24 Jul. 1970 178 p refs
(Contract NAS7-697)
(NASA-CR-110735; Rept-697-i) Avail: CFSTI CSCL 21H

An initial design study of heat-pipe-cooled thrust chambers is summarized. The program was aimed at applying heat pipe technology to the cooling of high energy space storable propellants and a specific goal was the design and fabrication of a working model OF2/B2H6 thrust chamber cooled by the heat pipe principle. Program tasks reported include: (1) heat pipe technology review; (2) analysis and experimentation; and (3) working model design. Author

N70-33241* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROCKET PROPELLANT INJECTOR Patent
Raymond L. Mantler, inventor (to NASA) Issued 14 Jun. 1960 (filed 21 Jun. 1955) 4 p Cl. 60-39.74
(NASA-Case-XLE-00103; US-Patent-2,940,259; US-Patent-Appl-SN-517100) Avail: US Patent Office CSCL 21H

The design of propellant injector for combustion chambers of rockets or rocket aircraft, with special adaptation to the combustion of an oxidant and a fuel, is described. This design contemplates the use of a plurality of parallel tubes, each slotted to provide a plurality of outlets, and alternate tubes having connections to different propellant sources. The slots of adjacent tubes are staggered to insure thorough mixing of the fuel ingredients. Design benefits include: (1) provision of propellant injectors so constructed as to permit close nozzle spacing; (2) simple construction, easy machining, and highly efficient performance; and (3) an injector that is readily scalable to any rocket engine chamber diameter; or thrust. A.L.

N70-33265* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLLOID PROPULSION METHOD AND APPARATUS Patent
Carl T. Norgren, inventor (to NASA) Issued 16 Mar. 1965 (filed 12 Mar. 1963) 4 p Cl. 60-35.3
(NASA-Case-XLE-00817; US-Patent-3,173,246; US-Patent-Appl-SN-264735) Avail: US Patent Office CSCL 21C

Method and apparatuses for propelling space vehicles are discussed, with emphasis on an onboard colloidal particle generator for an electrostatic engine. The propulsion method uses sub-micron sized particles for achieving realistic accelerating potentials and a colloidal particle generator with a supersonic nozzle for the thruster. R.B.

N70-33284* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANNULAR ROCKET MOTOR AND NOZZLE CONFIGURATION Patent

James F. Connors, inventor (to NASA) Issued 21 Aug. 1962 (filed 30 Mar. 1960) 8 p Cl. 60-35.6
(NASA-Case-XLE-00078; US-Patent-3,049,876; US-Patent-Appl-SN-18776) Avail: US Patent Office CSCL 21H

The high thrust rocket vehicle comprises an elongated body with payload located at the nose and turbopumps in the rear. The fuel and oxidant are pumped to an annular reservoir from which they flow through an annular injector and into the combustor and nozzle configuration. The design is likened to a cluster of rocket engines arranged in a circular ring about the missile's axis, and the individual motors are integrated into an annular combustor and nozzle configuration. In addition to the high thrust, the configuration provides adaptability of steering or thrust vectoring flaps, short overall length, low drag, improved stability and control, and solutions to jet interaction and base burning problems. N.E.N.

N70-33331* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPHERICAL SOLID-PROPELLANT ROCKET MOTOR Patent
Joseph G. Thibodaux, Jr., Robert L. Swain, and Carl R. Styles, inventors (to NASA) Issued 26 Sep. 1961 (filed 4 Mar. 1958) 6 p Cl. 60-35.6
(NASA-Case-XLA-00105; US-Patent-3,001,363; US-Patent-Appl-SN-719173) Avail: US Patent Office CSCL 21H

The spherical rocket engine is lighter than a cylindrical rocket of comparable operating characteristics, has higher loading densities, higher impulse to weight ratios, higher vaccuum velocities for a given payload, and greater ease in achieving interial stabilization. The engine consists of a pair of hemispheroidal casings rigidly secured together in which solid propellant masses of intricate form and substantial burning areas may be inserted without disassembly or disturbance of the container. The design also provides means for removing support structure film from the charge surfaces, radially burning charge surfaces, and means for having the charge self-supported. N.E.N.

N70-33356* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRO-THERMAL ROCKET Patent
J. R. Jack and W. E. Moeckel, inventors (to NASA) Issued 16 Jan. 1962 (filed 23 Sep. 1960) 3 p Cl. 60-35.5
(NASA-Case-XLE-00267; US-Patent-3,016,693; US-Patent-Appl-SN-58147) Avail: US Patent Office CSCL 21C

An electrothermal rocket employing an electrically powered, resistance heated heat exchanger is described. The device produced a propulsive jet through the heating of propellant during passage through or around the heated solid surfaces. The porous tungsten heat exchanger is an annulus of wound flattened tungsten wire. The engine is designed to operate for extended periods without major breakdown. R.B.

N70-33372* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTERNAL LIQUID-SPRAY COOLING OF TURBINE BLADES Patent
John C. Freche, Roy A. Mc Kinnon, and John M. Braschwitz, inventors (to NASA) Issued 14 Mar. 1961 (filed 11 Feb. 1957) 4 p Cl. 253-39.15
(NASA-Case-XLE-00037; US-Patent-2,974,925; US-Patent-Appl-SN-639589) Avail: US Patent Office CSCL 13A

A device is described for cooling gas turbine blades to prevent metal deterioration due to high temperature flow and to offer limited interference to the gas flow. The apparatus is designed to eliminate cooling ducts in the blade and spray bars which interfere with gas flow. R.B.

N70-33374* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOZZLE Patent
Blake W. Corson, Jr., inventor (to NASA) Issued 12 Dec. 1961 (filed 23 May 1960) 4 p Cl. 60-35.6
(NASA-Case-XLA-00154; US-Patent-3,012,400; US-Patent-Appl-SN-31242) Avail: US Patent Office CSCL 21E

An improved peripheral exhaust nozzle is described for a reaction motor capable of generating thrust with a high degree of efficiency by providing a peripheral outer wall adjacent to the end of the tailpipe, and which terminates in an inwardly curved lip at the jet exit. The nozzle includes a plug axially positioned to the outer wall, and means for afterburner fuel injection. F.O.S.

N70-33375* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR IGNITING SOLID PROPELLANTS Patent
Harrison Allen, Jr., Carl C. Ciepluch, and Edward A. Fletcher, inventors (to NASA) Issued 16 Mar. 1965 (filed 16 Mar. 1962) 4 p Cl. 60-35.6
(NASA-Case-XLE-00207; US-Patent-3,173,251; US-Patent-Appl-SN-180370) Avail: US Patent Office CSCL 21H

A system to ignite solid propellants by injecting hypergolic fluids to predetermined portions of the propellant is described. A tube of solid propellant has longitudinal bore through which a stream of hypergolic fluid is directed. The fluid is initially directed toward the wall before escaping from the opposite end of the bore. N.E.N.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-32003*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR INDICES FOR THE PERIOD 1 JANUARY 1955 -31 DECEMBER 1969
H. C. Euler 8 Jun. 1970 548 p
(NASA-TM-X-64526) Avail: CFSTI CSCL 03B

The solar-geomagnetic indices listed may be used for model atmosphere studies. These tables contain daily sunspot number, solar 10.7 cm flux and the daily geomagnetic A sub p index. Also included are the three-hourly K sub p and a sub p indices and 27-, 54-, and 81-day running means of sunspot numbers and solar flux. Author

N70-32181# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
VARIATIONS IN THE SOLAR ULTRAVIOLET FLUX, 13 JULY–9 AUGUST 1968
Arthur B. Prag and Fred A. Morse 15 Feb. 1970 25 p refs
(Contract F04701-69-C-0066)
(AD-704816; TR-0066(5260-10)-5; SAMSO-TR-70-144) Avail: CFSTI CSCL 3/2

Three simple photodiodes on board the SPADES satellite (1968-059A) have measured the near-earth solar flux in three broad wavelength intervals: 300-1150 A, 1150-1600 A, and 1600-2100 A. During the first 27 days of the satellites lifetime, the signals in the two longer wavelength intervals showed nonrandom variations of more than a factor of three, and the short wavelength flux varied by 60%. Except for the 1150-1600 A channel, the variation did not correlate well with F10.7; all three channels showed a much stronger correlation with the product of area and intensity of the calcium plage regions. The data are consistent with a model in which the effective plage temperature is about 1250 K degrees higher than the background sun at all wavelengths in the 300-2100 A interval. Author (TAB)

N70-32219# Saskatchewan Univ., Saskatoon. Inst. of Space and Atmospheric Studies.
BASIC RESEARCH ON AURORA AND AIRGLOW Final Report, 1 Jan. –31 Dec. 1969
Howard N. Rundle and Edward J. Llewellyn 31 Dec. 1969 41 p
(Contract F19628-69-C-0106)
(AD-704820; AFCRL-70-0149) Avail: CFSTI CSCL 4/1

The instrument currently in use for the spectroscopic and photometric observation of aurora and airglow are listed together with modifications and new developments of instrumentation. Modifications have been made to a two channel rocket-borne photometer that is used for measuring 1.27 micrometer radiation. A birefringent photometer has been modified to make it more useful for twilight measurements. Investigations have been carried out on the rotational temperatures derived from OH emissions. Further observations of 1.27micrometer oxygen emission have been made from both the ground and rocket flights. These measurements and others have been analysed so that many of the temporal and spatial properties of this emission are now known. An auroral component of this emission has also been investigated. Considerable theoretical investigations have been carried out on the photochemistry of oxygen and hydrogen to accompany the measurement of the OH and 1.27 micrometer O2 emissions. Hydrogen and atomic oxygen emissions have been measured in a hydrogen auroral arc. The results of analysis on a decade of twilight sodium density measruements are presented. Author (TAB)

N70-32451# Air Force Cambridge Research Labs., Bedford, Mass.
SOLAR OBSERVATIONS AT 8.6-mm WAVELENGTH
Paul M. Kalaghan and Larry E. Telford Jan. 1970 53 p refs
(AD-704552; AFCRL-PSRP-408; AFCRL-70-0052) Avail: CFSTI CSCL 3/2

The advent of manned space flights has focused attention on the biological threat posed by solar proton flares. In an effort to close one of the gaps in the observation of the solar spectrum, AFCRL has initiated a high resolution millimeter wavelength solar observation program. This report covers the observational approach and initial findings of this program based upon observations from May to December 1968. The equipment and procedures used to produce spectroheliograms at 8.6 mm, using the AFCRL 29-ft Millimeter Wave Antenna, are described. The quiet sun at 8.6 mm appeared to have a brightness temperature of 8400 plus or minus 600 K blackbody and a radio diameter 3 percent greater than the optical disk. The presence of active regions during this period was characterized by localized enhanced regions exhibiting temperature increases from 1 to 28 percent of the quiet sun level. The enhancement and the positions of these regions have been compared with 9.1-cm radio data and various other optical data. The locations of the 8.6-mm enhanced regions are contained within calcium plages. All proton events observed originated only in highly enhanced (Class III) regions. Further observations are in progress to increase the sample size of observed proton events to further refine the possibility of prediction of these events. Author (TAB)

N70-32521# Institut d'Aeronomie Spatiale de Belgique, Brussels.
BIBLIOGRAPHY, GROUP 7C. 1: TERRESTRIAL SPACE [BIBLIOGRAPHIE, FASCICULE 7C. 1: ESPACE TERRESTRE]
1969 101 p refs In FRENCH
Avail: CFSTI

A bibliography of current data on solar radiation, cosmic radiation, and the structure of the upper atmosphere is presented.
Transl. by J.M.C.

N70-32531*# Columbia Univ., New York.
MEASUREMENT OF THE COSMIC MICROWAVE BACKGROUND BY OPTICAL OBSERVATIONS OF INTERSTELLAR MOLECULES
John Francis Clauser (Ph.D. Thesis) [1970] 169 p refs
Sponsored by NASA
(NASA-CR-110690) Avail: CFSTI CSCL 03B

The background intensity from the short wavelength spectra of interstellar molecules is calculated. Techniques of spectrophotometry are developed and the resulting upper limits are discussed. Possible excitation schemes consistent with existing theories for the interstellar medium are analyzed with respect to the observed invariance of the excitation of the interstellar molecules and the results of 21 cm H 1 observations in the direction of these molecular clouds. Author

N70-32729*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
CORRELATION OF X-RAY RADIATION (2 - 12 A) WITH MICROWAVE RADIATION (10.7 cm) FROM THE NON-FLARING SUN, 1 JULY 1966 – 25 DECEMBER 1968
Jean Gibson and James A. van Allen 4 Apr. 1970 66 p refs Revised
(Contract NAS5-9076; Grant NGL-16-001-002; Contract N00014-68-A-0196-003)
(NASA-CR-109622; Rept-70-5-Rev) Avail: CFSTI CSCL 03B

Absolute values of the X-ray flux in the 2 - 12 A range, F(2 - 12 A), from the whole disc of the non-flaring sun are reported for 734 days during the period 1 July 1966 to 25 December 1968. The data came from equipment on the earth-orbiting satellite Explorer 33 and the moon-orbiting satellite Explorer 35. It is found that F(2 - 12 A) is essentially constant over time periods of the order of one day but varies by a factor as great as 6 over time periods of the order of one month. A correlation study of F and the radio power density flux P at 10.7 cm rejects a linear relationship on both empirical and physical considerations. Author

N70-32948*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ACCELERATION OF RELATIVISTIC ELECTRONS IN SOLAR PROTON FLARES
Kunitomo Sakurai Jul. 1970 25 p refs Submitted for publication
(NASA-TM-X-63969; X-693-70-259) Avail: CFSTI CSCL 03B

The acceleration mechanism of relativistic electrons in solar flares is considered by taking into account the physical condition of accelerating regions such as plasma density and magnetic field intensity. For the electrons of the kinetic energy range approximately or less than 10 Mev, it is shown that the Fermi acceleration is more effective than the betatron acceleration. The most plausible values of the plasma number density and the strength of sunspot magnetic fields in the accelerating regions are estimated. This suggests that the accelerating regions are located somewhere above the H alpha-flare regions. The accelerating regions may be identified with the triggering regions of solar flares, and so approximately satisfy the force-free condition as regards magnetic field configuration. The accelerated electrons and their relation to the emission of type 4 radio bursts are briefly discussed. Author

N70-33083*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEUTRAL COMPOSITION AND DENSITY RESULTS FROM THE EXPLORER 32 MASS SPECTROMETERS
C. A. Reber, A. E. Hedin, J. E. Cooley, and D. N. Harpold May 1970 56 p refs Submitted for publication
(NASA-TM-X-63961; X-621-70-222) Avail: CFSTI CSCL 03B

The magnetic mass spectrometers on the Explorer 32 Aeronomy satellite provided data on the neutral atmospheric constituents in the altitude range 286 kilometers to 1000 kilometers from 26 May to 1 June 1966. Comparison with the Jacchia 1965 model shows good agreement for N2 densities and the measured atomic oxygen about a factor of five lower than the model. The ion sources of the mass spectrometers were enclosed and coated to enhance recombination of the atomic oxygen; it is likely that significant loss of oxygen occurred on the walls. The data for N2

and O are best fitted with an increase in exospheric temperature of about 160° or a much smaller latitudinal temperature effect than the model predicts, along with a decrease in atomic oxygen density with increasing latitude. Author

N70-33064*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVIDENCE OF SOLAR GEOMAGNETIC SEASONAL CONTROL OF THE TOPSIDE IONOSPHERE
H. A. Taylor, Jr. Jun. 1970 4 p refs Submitted for publication
(NASA-TM-X-63968; X-621-70-258) Avail: CFSTI CSCL 03B

Both the location and prominence of distinct ionospheric features are found to change significantly between longitudes for which the angle between the earth-sun line and dipole equator has its greatest variation. It is found that the ambient ion concentrations at a given latitude may change by as much as an order of magnitude between contrasting longitudes, even though the altitude and magnetic activity remain nearly constant. The persistence of the longitudinal asymmetry over a range of local times, seasons, and magnetic conditions reveals that the topside ionosphere is dependent upon a solar magnetic rather than a solar seasonal control. This variation, which may involve large scale transport of both ions and neutral particles, presents an added complication to the studies of the topside ionosphere. These results indicate that investigations of both long and short term changes in the ion composition must, to be rigorous, take into consideration the solar geomagnetic seasonal effects. Author

N70-33075*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGETIC ELECTRONS ASSOCIATED WITH SOLAR FLARES AND THEIR RELATION TO TYPE 1 NOISE ACTIVITY
Kunitomo Sakurai Jul. 1970 21 p refs Submitted for publication
(NASA-TM-X-63966; X-693-70-252) Avail: CFSTI CSCL 03B

The generation of energetic electrons is always associated with the solar flares which occur within the sunspot groups that are highly active in emitting type 1 noise storms. The number of the solar flares which are associated with the distinct electron events observed at the earth tends to increase in association with the westward movement of these active groups. This tendency is not contradictory to the close association between electron producing solar flares and type 1 active regions if we take into account the limited directivity of type 1 noise storms associated with these sunspot groups. The acceleration of the energetic electrons associated with solar flares seems to be closely related to the type 1 active regions where the enormous numbers of suprathermal electrons exist and play a role in generating these radio noise storms. Author

N70-33076*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE CHARACTERISTICS OF THE SOLAR ACTIVE REGIONS RESPONSIBLE FOR THE GENERATION OF TYPE 3 RADIO BURSTS AT HECTOMETRIC FREQUENCIES IN AUGUST 1968
Kunitomo Sakurai Jul. 1970 20 p refs Submitted for publication
(NASA-TM-X-63967; X-693-70-253) Avail: CFSTI CSCL 03B

The RAE (Radio Astronomy Explorer) satellite observed enormous numbers of type 3 radio bursts at hectometric wavelengths from 13 to 25, August in 1968. The drift rate of these bursts reached a maximum around the middle of August. This means that the source responsible for these bursts gradually moved on the solar disk in association with the rotation of the sun. During this period, there were two large active sunspot groups, MacMath nos. 9593 and 9597, which were located in the southern hemisphere and adjacent to each other. By examining the observational data on solar flares, type 1 noise storm activity and energetic electron flux increases, it is shown that the active region, MacMath no. 9597 is responsible for the generation of these type 3 radio bursts. The relation between type 3 bursts producing electron beams and type 1 noise activity is briefly discussed and a model of this active region is qualitatively described. Author

N70-33128# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTIMATTER AND THE UNIVERSE
N. A. Vlasov 13 Mar. 1970 18 p refs Transl. into ENGLISH from Priroda (Moscow), no. 9, 1964 p 20–25
(AD-705145; FTD-MT-24-390-69) Avail: CFSTI CSCL 3/2

The article discusses the fundamental problems concerning the symmetry of the Universe with respect to matter and antimatter in popular terms. After a brief discussion of the work of Burbridge and Hoyle, it is pointed out that the existing reasons for doubting the possibility of such symmetry are insufficiently substantiated. The cosmological difficulties in devising a symmetrical Universe do not appear to be insoluble. After an analysis of the phenomena which take place in a symmetric plasma, as indicated by Alven and Klein, the author charts the methods of solving these difficulties. Some methods of observing antimatter are examined, and the article draws attention to the importance of developing experimental methods for detecting antimatter, in particular, to the most effective methods of gamma-astronomy and optical astrophysics. It concludes that the process of annihilation should be studied as one of the possible causes of some observed but not yet explained astronomical phenomena. TAB

N70-33160*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL EMISSION SPECTRA OF THE EARTH AND ATMOSPHERE OBTAINED FROM THE NIMBUS 4 MICHELSON INTERFEROMETER EXPERIMENT
R. A. Nanel and B. J. Conrath Jun. 1970 14 p refs Submitted for publication
(NASA-TM-X-63974; X-620-70-244) Avail: CFSTI CSCL 03B

Thermal emission spectra of the earth and atmosphere in the spectral range 400 to 1500 cm (−1) with a resolution equivalent to 2.8 cm (−1) have been obtained with the Michelson interferometer flown on the Nimbus 4 satellite. A study of selected samples indicate that the spectra are of sufficiently high quality to permit the recovery of atmospheric temperature, humidity, and ozone profiles on a global basis, as well as the study of surface reststrahlen effects and other geophysical and meteorological phenomena. Author

N70-33162*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY LOSS OF COSMIC RAYS IN THE INTERPLANETARY MEDIUM
M. L. Goldstein (Maryland Univ.), L. A. Fisk, and R. Ramaty Jul. 1970 10 p refs Submitted for publication
(NASA-TM-X-63977; X-660-70-272) Avail: CFSTI CSCL 03B

The expansion of the solar wind is likely to cause low energy cosmic ray particles to lose a significant fraction of their energy in the interplanetary medium. It is shown that because of this effect, most of the protons observed below 100 MeV and alpha particles, below 60 MeV/nucleon originate at higher energies, making it impossible to sample directly the interstellar spectra at these energies. Author

N70-33163*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A "SOURCE SURFACE THEORY" COROLLARY: THE MEAN SOLAR FIELD-INTERPLANETARY FIELD CORRELATION

K. H. Schatten Jun. 1970 11 p refs Submitted for publication
(NASA-TM-X-63971; X-692-70-264) Avail: CFSTI CSCL 03B

The correlation of the mean solar magnetic field and the interplanetary magnetic field has been interpreted by comparing the relationship of the measurement of the mean solar field with the physics involved in the formation of the interplanetary field. The high correlation observed is thus interpreted as a fortuitous correspondance between two integrals. The high correlation thus provides further support for the source surface model involved in these calculations. A new method is then suggested for observing the "mean solar field" that might improve the correlations slightly.
Author

N70-33172# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF HALF-WIDTHS OF THE H ALPHA LINE AND RADIAL VELOCITIES IN THE CYGNUS LOOP
V. T. Doroshenko [1970] 6 p refs Transl. into English from Astron. Zh. (USSR), no. 2, 1970 p 292–296
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

On the basis of an analysis of the half-widths of the H alpha line it is shown that the mean half-width is 40 km/sec in filaments and 63 km/sec in diffuse formations. The root mean square deviations of the half-widths are also distinguished. They are + or − 15 km/sec in the filaments, and + or − in 22 km/sec in the diffuse medium. It is shown that the results obtained from an analysis of the radial velocities in Cygnus completely agree with earliers results: the velocity of nebular expansion is 110 km/sec, the radial velocity of the object as a whole is + 16 km/sec, and the radial velocities of the filaments and diffuse formations do not differ.
Author

N70-33173# Lockheed Missiles and Space Co., Palo Alto, Calif.
MEASUREMENT OF THE ABSORBED DOSE OF COSMIC RADIATION ON THE COSMOS-228
B. M. Makhmudov et al [1970] 4 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. III, Fiz. Astron. (USSR), no. 2, 1970 p 225–229
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Radiometric apparatus on the Cosmos 228 consisted of a scintillation counter, ionization chamber, and five gas discharge counters, three of which were provided with magnetic electron analyzers. Geographic maps showing lines of equal intensity and absorbed doses in the form of isodosages are given. It was found that the geomagnetic formation of primary cosmic rays continues to play a governing role in absorbed dose intensity at low latitudes, and the greatest dose intensities are in the area of the Brazil magnetic anomaly.
N.E.N.

N70-33221# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE RELATIVE LINE INTENSITY OF THE Fe(XVII) ION. EFFECTIVE EXCITATION CROSS-SECTIONS OF INTERCOMBINATIONAL TRANSITIONS IN He AND Fe(XVII)
I. L. Beigman et al [1970] 7 p refs Transl. into ENGLISH from Russian preprint, 1968 13 p
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Line intensities corresponding to transitions from the configurations 2p5 3s and 2p5 3d into the ground state of the Fe(XVII) ion in the solar corona were measured previously, and gave the relative intensity of the 3s-2p and 3d-2p lines to be 1.3. It is shown that the high line intensity with the 3s configuration is due to cascade radiative processes through the levels of the 3p and 3d configurations. Exchange effects and electron excitation from the s-shell play an essential part in the population of these levels. Deexcitation because of collision with electrons can be neglected. Cross sections for the 1s-2s and 1d-2p transitions in the He(+) ion for the 2p-3s, 2p-3p, and 2p-3d transitions in Fe(XVII) ion are tabulated.
Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-32019*# Translation Consultants, Ltd., Arlington, Va.
LUMINOSITY FLUCTUATIONS OF THE PLANETS MARS, JUPITER, SATURN, URANUS, AND NEPTUNE, AND ASSOCIATED PHENOMENA [UBER HELLIGKEITSSCHWANKUNGEN DER PLANETEN MARS, JUPITER, SATURN, URANUS, NEPTUN, UND DAMIT ZUSAMMENHANGENDE ERSCHEINUNGEN]
Wilhelm Becker Washington NASA Jun. 1970 28 p refs Transl. into ENGLISH from Sitz-Ber. Preuss. Akad. Wiss., Physik. - Math. Kl. (East Germany), 1933 p 839–859
(Contract NASw-2038)
(NASA-TT-F-13128) Avail: CFSTI CSCL 03B

Luminosity data for the planets Mars, Jupiter, Saturn, Uranus, and Neptune, acquired by 28 different observers during the period from 1843 through 1931, are reduced to the Harvard system and compiled in tabular form as well as plotted in the form of luminosity curves. It is found that no connection exists between the luminosity fluctuations of these planets since the locations of their maxima and minima fail to coincide. This will exclude any central cause such as changes in solar radiation. The theory is advanced that these fluctuations may be due to changes in the "cloud cover" of the planets which affect the albedo of the planetary surface.
Author

N70-32027*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMUM LAUNCH TRAJECTORIES FOR THE ATS-E MISSION
Omer F. Spurlock and Fred Teren [1970] 17 p refs Proposed for presentation at Astrodynamics Conf., Am. Astronautical Soc. and AIAA, Santa Barbara, Calif., 20–21 Aug. 1970
(NASA-TM-X-52836) Avail: CFSTI CSCL 22C

Optimum trajectories for the Applications Technology Satellite (ATS)-E mission are obtained. Analysis, procedure, and results are presented. The trajectories are numerically integrated from launch to insertion into the final orbit. As a result of a much smaller than optimum apogee motor, these trajectories, unlike conventional synchronous orbit trajectories, require non-circular parking orbits and large amounts of inclination reduction before the solid motor burn at apogee. Constraints on parking orbit perigee radius and duration are included. Figures are presented describing the results.
Author

N70-32078# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHODS OF DETERMINING ARTIFICIAL EARTH SATELLITE ORIENTATION BY TELEMETRY MEASUREMENTS
E. K. Lavrovskii et al 1970 13 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 8, no. 2, 1970 p 218–288
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method of determining the orientation of almost dynamically symmetric satellites by means of onboard sensors is elucidated. The information is processed by the least squares method, and quasi-regular precession is taken as the motion model.
Author

N70-32094*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ASTRONOMY AND ASTROPHYSICS, NO. 6: ANNULAR SOLAR ECLIPSE, 20 MAY 1966

A. A. Gorynya, ed. Washington NASA Jun. 1970 61 p refs Transl. into ENGLISH of the publ. "Astrometriya i Astrofizika, 6, Koltseobraznoye Solnechnoye Zatmeniye, 20 Maya 1966 g" Kiev, Naukova Dumka Press, 1968 p 4–83
(Contract NASw-1692)
(NASA-TT-F-621) Avail: CFSTI CSCL 03B

CONTENTS:

1. THE LUNAR PROFILE ACCORDING TO OBSERVATIONS OF THE ANNULAR ECLIPSE OF 20 MAY 1966 I. M. Demenko et al p 3–42 refs (See N70-32095 17-30)

2. DETERMINING CORRECTIONS FOR THE COORDINATES OF THE MOON ACCORDING TO OBSERVATIONS OF THE ANNULAR SOLAR ECLIPSE ON 20 MAY 1966 I. M. Demenko et al p 43–50 refs (See N70-32096 17-30)

3. THE ACCURACY OF THE DETERMINATION OF THE COORDINATES OF THE SITE AND THE MOMENTS OF OBSERVATION OF THE ANNULAR SOLAR ECLIPSE OF 20 MAY 1966 N. A. Vasilenko p 51–53 refs (See N70-32097 17-30)

4. DESCRIPTION OF THE HIGH-SPEED CASSETTE AND SHUTTER USED TO OBSERVE THE ANNULAR SOLAR ECLIPSE OF 20 MAY 1966 K. Ye. Skorik p 54–57 (See N70-32098 17-30)

N70-32095*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

THE LUNAR PROFILE ACCORDING TO OBSERVATIONS OF THE ANNULAR ECLIPSE OF 20 MAY 1966

I. M. Demenko et al *In its* Astronomy and Astrophys., No. 6 Jun. 1970 p 3–42 refs (See N70-32094 17-30)
Avail: CFSTI CSCL 03B

Unique values were determined for the dimensions and direction of prolation of the lunar profile from previous observations and photographs and from the annular solar eclipse of 1966. Instead of a circle, two plane figures, an ellipse and a limacon of Pascal, are proposed, which best equalize the fine relief. The limacon of Pascal best fits the observations and explains the contradictions presently known. A method is proposed for determining the coordinates of the center of the lunar mass from observations. R.B.

N70-32096*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

DETERMINING CORRECTIONS FOR THE COORDINATES OF THE MOON ACCORDING TO OBSERVATIONS OF THE ANNULAR SOLAR ECLIPSE ON 20 MAY 1966

I. M. Demenko et al *In its* Astronomy and Astrophys., No. 6 Jun. 1970 p 43–50 refs (See N70-32094 17-30)
Avail: CFSTI CSCL 03B

Formulas are proposed for calculating the azimuth of a coronograph with an immovable lens. The proposed method is more accurate because rings were investigated which cover longer arcs of the lunar limb than those previously used. Corrections are given for ephemeris time from results of observations of the annular solar eclipse of 1966. R.B.

N70-32097*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

THE ACCURACY OF THE DETERMINATION OF THE COORDINATES OF THE SITE AND THE MOMENTS OF OBSERVATION OF THE ANNULAR SOLAR ECLIPSE OF 20 MAY 1966

N. A. Vasilenko *In its* Astronomy and Astrophys., No. 6 Jun. 1970 p 51–53 refs (See N70-32094 17-30)
Avail: CFSTI CSCL 03B

For maximum observation of the annular solar eclipse of May 20, 1966, precise coordinates were determined for the site and moments of observation. An ultraviolet universal instrument, naval chronometers, chronographs, an all-wave receiver, an aneroid barometer, and thermometers were used for the measurements. The mean square error in determining the latitude of the astropoint is given and the longitude and latitude of the astropoint were determined according to standard systems. R.B.

N70-32098*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

DESCRIPTION OF THE HIGH-SPEED CASSETTE AND SHUTTER USED TO OBSERVE THE ANNULAR SOLAR ECLIPSE OF 20 MAY 1966

K. Ye. Skorik *In its* Astronomy and Astrophys., No. 6 Jun. 1970 p 54–57 (See N70-32094 17-30)
Avail: CFSTI CSCL 03B

Observations of the annular solar eclipse required that the astronomical instruments be equipped with high-speed cassettes for use with photographic plates 18 × 24 cm and a reloading speed of less than 1 sec, a high cassette capacity to obtain the required number of photographs, and high-speed shutters for the given plate dimensions and exposure times from 1/50 to 1/1000 sec or less. Because there were no industrial prototypes of the cassettes and shutters, they were developed specifically for the solar eclipse expedition. R.B.

N70-32117*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.

THE LIBRATIONAL DYNAMICS OF SATELLITES

J. E. Lingerfelt and T. P. Mitchell 30 Jan. 1970 56 p refs
(Grant NGR-05-010-020)
(NASA-CR-110625; UCSB-ME-70-9) Avail: CFSTI CSCL 22C

CONTENTS:

1. MOTION OF A SATELLITE WITH TIME DEPENDENT INERTIA TENSOR p 1–39 refs (See N70-32118 17-30)

2. THE LIBRATIONAL DYNAMICS OF A COMPOSITE RIGID-ELASTIC SATELLITE p 40–53 refs (See N70-32119 17-30)

N70-32118*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.

MOTIONS OF A SATELLITE WITH TIME DEPENDENT INERTIA TENSOR

In its The Librational Dyn. of Satellites 30 Jan. 1970 p 1–39 refs (See N70-32117 17-30)
Avail: CFSTI CSCL 22C

The equation of planar libration for a satellite in orbit is examined in some detail. First, the stability of the solutions, where the motion is defined to be stable if it remains librational, is studied where sufficient conditions for stability are derived. The case where deployment is rapid with respect to the orbital period is considered. The equation is also studied for the case where the inertial parameters vary slowly with respect to an orbital period. Asymptotic techniques are utilized averaging in the first case about the linearized solution of the constant parameter case and in the second case, about the exact nonlinear solution of the constant parameter case. Closed form approximate solutions are presented for particular cases. A power series solution is presented for the linearized equation. Author

N70-32119*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.

THE LIBRATIONAL DYNAMICS OF A COMPOSITE RIGID-ELASTIC SATELLITE

In its The Librational Dyn. of Satellites 30 Jan. 1970 p 40–53 refs (See N70-32117 17-30)
Avail: CFSTI CSCL 22C

The conditions under which librational and flexural resonances may be induced in a satellite consisting of a rigid central mass from which a lengthy flexible element extends are derived. The influence of the central body on the flexible element is specifically taken into account. The center of mass of the composite satellite is assumed to move in an elliptic planar orbit. Author

N70-32126*# Philco-Ford Corp., Palo Alto, Calif.
ACQUISITION, SEARCH, TRACK
In its Study of Efficient Transmission and Reception of Image-Type Data Using Millimeter Waves 15 Mar. 1970 47 p (See N70-32120 17-07)
Avail: CFSTI CSCL 22A

Acquisition and tracking of a data relay satellite by a sensor satellite, using millimeter waves, requires very high gain antennas (60 DB gain) for both satellites to provide the necessary link margin. This results in very narrow bandwidths for both antennas and acquisition may never be accomplished. This can be overcome by the sensor satellite using a separate low gain wide beamwidth antenna for the initial acquisition phase and then switching to the high gain antenna when acquisition is achieved. The general problems of search, acquisition, and track are addressed assuming that this narrow-beam/broad-beam capability is present. Author

N70-32185# California Univ., Berkeley. Space Sciences Lab.
SOLAR EMISSIONS FROM CENTERS OF ACTIVITY NEAR 1.2-CENTIMETER WAVELENGTH
Mohamed El-Raey 15 Apr. 1970 16 p refs *Its* Ser. No. 11, Issue 31
(Contract N00014-69-A-0200-1006)
(AD-705123) Avail: CFSTI CSCL 3/2

Absolute flux density, height, and directivity of a strong source of the slowly varying component of solar millimeter emissions are discussed. The mechanism of gyromagnetic emissions is suggested to explain the observed flux spectrum, as well as peculiar emissions from unipolar spots at the solar limb. It is believed that the highly active sources of millimeter emissions tend to lie at a relatively higher level in the solar atmosphere than does the average of lower activity sources. A routine observation of solar sources of millimeter wavelength emissions is being conducted with a more refined mapping technique. Author (TAB)

N70-32226*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
GOALS AND MEANS IN THE CONQUEST OF SPACE
R. G. Perelman Washington NASA May 1970 182 p refs Transl. into ENGLISH of the publ. "Tseli i Puti Pokoreniya Kosmosa" Moscow, Nauka Press, 1967 p 1-210
(Contract NASw-1692)
(NASA-TT-F-595) Avail: CFSTI CSCL 22A

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1. ASTRONAUTICS (DEVELOPMENTS AND GOALS) p 1-46 refs (See N70-32227 17-30)
2. IN THE SPACE AROUND THE SUN p 47-115 refs (See N70-32228 17-30)
3. IN THE DEPTHS OF THE GALAXY p 116-155 refs (See N70-32229 17-28)
4. THROUGH THE ARMOR OF TIME AND DISTANCE p 156-174 refs (See N70-32230 17-30)

N70-32227*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ASTRONAUTICS (DEVELOPMENTS AND GOALS)
In its Goals and Means in the Conquest of Space May 1970 p 1-46 refs (See N70-32226 17-30)
Avail: CFSTI CSCL 22A

Development and goals of the space age are presented, as well as some general characteristics of the different planets in this solar system. The basic goal of astronautics is discussed which is to make contact with intelligent beings of other planets. The production of cosmic power units is also proposed. J.A.M.

N70-32228*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
IN THE SPACE AROUND THE SUN
In its Goals and Means in the Conquest of Space May 1970 p 47-115 refs (See N70-32226 17-30)
Avail: CFSTI CSCL 22A

Artificial earth satellites are classified into four types in terms of designation and size, and the various types of electronic and sensor equipment are reviewed. Transmission and receiving equipment are also briefly mentioned. J.A.M.

N70-32230*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THROUGH THE ARMOR OF TIME AND DISTANCE
In its Goals and Means in the Conquest of Space May 1970 p 156-174 refs (See N70-32226 17-30)
Avail: CFSTI CSCL 22A

Einstein's principle of relativity is examined in terms of interplanetary space flight. Time effects on earth from a minimal spacecraft sent to Proxima Centauri are studied, as well as the biological effects of the relativity theory during space flight, emphasizing acceleration effects. The possibility of spacecraft maximum velocity being 94 percent the speed of light is calculated for galactic travel. J.A.M.

N70-32267*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-61, VOLUME 3 FOR THE PERIOD 1 DECEMBER 1969 - 31 JANUARY 1970. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
28 Feb. 1970 276 p refs
(Contract NAS7-100)
(NASA-CR-110628; JPL-SPS-37-61-Vol-3) Copyright. Avail: CFSTI CSCL 22A

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3. PHYSICS p 8-24 refs (See N70-32270 17-30)
4. COMMUNICATIONS SYSTEMS RESEARCH p 25-89 refs (See N70-32271 17-07)
5. COMMUNICATIONS ELEMENTS RESEARCH p 90-120 refs (See N70-32272 17-07)
6. SPACECRAFT RADIO: TOPS RADIO FREQUENCY SUBSYSTEM A. W. Kermode p 121-125 (See N70-32273 17-07)
7. SPACECRAFT TELECOMMUNICATIONS SYSTEMS: A DIGITAL COMMAND SYSTEM DEVELOPMENT C. R. Tegnelia p 126-129 refs (See N70-32274 17-07)
8. SPACECRAFT POWER p 130-148 (See N70-32275 17-03)
9. SPACECRAFT CONTROL p 149-164 refs (See N70-32276 17-14)
10. MATERIALS p 165-170 refs (See N70-32277 17-14)
11. APPLIED MECHANICS p 171-190 refs (See N70-32278 17-07)

12. SOLID PROPELLANT ENGINEERING p 191-212 refs (See N70-32279 17-27)
13. POLYMER RESEARCH p 213-241 refs (See N70-32280 17-06)
14. RESEARCH AND ADVANCED CONCEPTS p 242-249 (See N70-32281 17-12)
15. LIQUID PROPULSION: MATERIAL COMPATIBILITY O. F. Keller and L. R. Toth p 250-251 (See N70-32282 17-27)
16. SYSTEMS ANALYSIS RESEARCH p 252-262 refs (See N70-32283 17-30)

N70-32268*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FUTURE PROJECTS: GEOPHYSICAL EXPERIMENTS FOR THE MANNED PORTION OF A LUNAR ROVING VEHICLE MISSION
R. G. Brereton *In its* Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 1-4 (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 22A

The scientific experiments to be performed during the follow-on series of lunar missions starting with Apollo 20 are outlined. The objectives and tasks in the areas of geology, geophysics, bioscience, and geodesy are indicated, and the specific objectives and requirements for gravity, active seismic, magnetometry, and electrical prospecting experiments are described. N.E.N.

N70-32269*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIOSCIENCE: ANALYSIS OF THE ATMOSPHERE OF JUPITER: REQUIREMENTS FOR A COMBINED ATMOSPHERIC GAS CHROMATOGRAPHIC MASS SPECTROMETER
G. P. Shulman and P. G. Simmonds *In its* Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 5-7 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 03B

Problems associated with determining the composition of an unknown atmosphere and a proposed instrument system are discussed. It is felt that a low resolution mass spectrometer has limited capability and a gas chromatograph will be required for analysis of hydrogen cyanide, formaldehyde, and their oligomers. A dual-column gas chromatograph, with one column for polar and the other for nonpolar compounds, is described. A direct inlet via molecular leak to the mass spectrometer and a separate ion cross section chromatographic detector provide redundancy. N.E.N.

N70-32270*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHYSICS
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 8-24 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 03B

The electronics, deployment, and observations of the solar wind spectrometer deployed on the moon by the Apollo 12 crew are described. Initial data indicate that the solar wind strikes the moon but little if any change occurs. Experiments are described which were designed to measure the rate and pressure dependence of the reaction of excited atomic oxygen and carbon dioxide to yield carbon trioxide in the gas phase, for determining the role of carbon trioxide in Mars and Venus atmospheres. The ion chemistry in methane ammonia mixtures was studied using ion cyclotron resonance techniques. Gage transformation of the second post-Newtonian equations of hydrodynamics are discussed from the uniform standpoint of active transformation. N.E.N.

N70-32283*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEMS ANALYSIS RESEARCH
In its Space Programs Sum. No. 37-61, Vol. 3 28 Feb. 1970 p 252-262 refs (See N70-32267 17-30)
Copyright. Avail: CFSTI CSCL 03B

Mathematical discussions are presented on lunar motion, forward smoothing of sequentially correlated processes, probabilities of mission failure for solar electric propulsion systems, and measurement of the sun's angular momentum. N.E.N.

N70-32306*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BREAKDOWN STUDIES FOR POSSIBLE ATMOSPHERES ON MARS AND VENUS
J. A. Gardner *In its* Proc. of the 2d Workshop on Voltage Breakdown in Electron. Equipment at Low Air Pressure 30 Jun. 1970 p 183-188 ref (See N70-32286 17-09)
Avail: CFSTI CSCL 03B

Experimental data of gaseous breakdown resulting from an applied electric field are presented for three component mixtures of gases which are in the range of individual concentrations believed to exist on the planets Mars and Venus. The experimental investigations were performed for scientific missions to be sent to the surfaces or to penetrate the atmospheres of these planets. The important parameters are the breakdown potential and the product of gas pressure and electrode separation distance and are sufficient to generate the well-known Paschen curves. Author

N70-32489*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Solar Observatory.
HIGH RESOLUTION STUDY OF THE SOLAR ATMOSPHERE Final Report
Harry E. Ramsey May 1970 17 p ref
(Contract NASw-1890)
(NASA-CR-110888; LMSC-695791) Avail: CFSTI CSCL 03B

The final design and procurement of a large solar spar for use in high resolution solar studies, and the implementation of a new program involving high-resolution time-lapse photography of the sun in the D(3) line of neutral helium are presented. The conclusions reached after limited observations are: (1) Less than 10% of all H-alpha flares display readily visible activity in D(3). (2) D(3) activity when observed appears partially analogous to H-alpha flares observed with broad-band filters. (3) D(3) emission occurs in small concentrated centers closely associated with sunspots. (4) The low optical density of D(3) offers more effective studies of active centers as they traverse the limb. F.O.S.

N70-32564# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
BRIGHTNESS TEMPERATURES OF THE QUIET SUN AND THE NEW MOON AT 3.3 AND 5.7 mm WAVELENGTHS, JULY 1967-JULY 1969
Earl E. Reber 12 Feb. 1970 37 p refs Revised
(Contract F04701-69-C-0066)
(AD-705135; TR-0066(5230-46)-2; SAMSO-TR-70-155) Avail: CFSTI CSCL 3/2

Absolute brightness temperatures and brightness temperature ratios of the quiet sun and the center of the new moon were measured at the 3.3-mm wavelength and at several wavelengths in the 5.7-mm region. Radiometric maps of the sun and new moon are used to illustrate the problems associated with brightness temperature measurements of these sources. Measured quiet-sun/new-moon brightness temperature ratios and reported central brightness temperatures of the new moon in the millimeter wavelength region confirm the measured absolute brightness temperatures of the quiet sun. Reported solar brightness temperatures in the 5.7- to 1.0-mm wavelength interval are tabulated and presented graphically as a function of frequency and wavelength. The regression-line equation computed for the reported measurements is given for estimating solar brightness temperatures at any wavelength in this interval and is solved for the wavelengths of the reported measurements. Author (TAB)

N70-32586# Institut d'Aeronomie Spatiale de Belgique, Brussels.
BIBLIOGRAPHY, GROUP 6. 2: INTERPLANETARY SPACE [BIBLIOGRAPHIE, FASCICULE 6. 2: ESPACE INTERPLANETAIRE]
1969 78 p refs In FRENCH
Avail: CFSTI

Bibliographic data on the Moon, Venus, Mars, comets, cosmic radiation, gravitation, and the structure of the interplanetary space are presented. Transl. by J.M.C.

N70-32604# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCIENCE EXPANDS ITS HORIZONS: THE MYSTERIOUS WORLD OF THE GALAXIES
V. Ambartsumyan 6 Mar. 1970 12 p Transl. into ENGLISH from Pravda (Moscow), 1 Feb. 1970 p 3
(AD-704761; FTD-HT-23-169-70) Avail: CFSTI CSCL 3/2

Discoveries of the radio nebulae and radio galaxies has led to discussions of the nuclei process of galaxies and quasars. TAB

N70-32615# Arizona Univ., Tucson.
UBVRIJKL PHOTOMETRY OF CLASSICAL CEPHEID VARIABLE STARS AND UBVRIJHKLM PHOTOMETRY OF M SUPERGIANT STARS Final Report, 1 Nov. 1966–31 Aug. 1968
Harold L. Johnson 27 Feb. 1970 8 p refs
(Contract N00014-67-C-0168)
(AD-702051) Avail: CFSTI CSCL 3/2

Light curves of 20 Cepheid variable stars have been defined by our observations made with UBVRIJKL FILTERS5 The intrinsic colors of these stars were determined at various phases of the light curves, and at minimum light these colors seem quite similar to those of supergiant stars of the same spectral type. Bolometric corrections were computed and applied to the observations in order to derive the bolometric-magnitude curves. The temperature variations occurring in each star and the relative changes in each stellar radius were determined. The changes in kilometers of the stellar radii were obtained from observations of the radial velocity curves, and the stellar absolute magnitudes were then determined. UBVRIJHKLM observations of 105 high luminosity stars of M spectral type have been obtained. There are 390 observations with the UBVRI filters and 460 with the JHKL filters. Very few observations were made with the N filter, and these have been excluded. The reduction and analysis of the observational data has been completed. TAB

N70-32658# California Univ., Berkeley. Space Sciences Lab.
SOLAR RADIATION AND ATMOSPHERIC ABSORPTION IN THE MILLIMETER WAVE REGION Semiannual Report, 1 Aug. 1969–31 Jan. 1970
Samuel Silver and William J. Welch 31 Jan. 1970 5 p refs *Its* Space Sci. Lab. No. 11, Issue 19
(Contracts Nonr-222(54); N00014-69-A-0200-1006)
(AD-703697) Avail: CFSTI CSCL 3/2

The general goals of the millimeter program are the development of new electronic techniques and calibration techniques and the application of these developments to observational problems dealing with astronomical radio sources both within and without the solar system. During the past interval, work has continued in all these areas, with the main instrumental development being the new millimeter wave interferometer. Observational studies are either in process or complete for the following radio sources: Virgo A, Saturn, Venus, Jupiter, the sun, galactic molecular line sources, and all the observable quasi-stellar objects and related objects. Author (TAB)

N70-32759*# Aerophysics Research Corp., Bellevue, Wash.
ATMOSPHERIC AND NEAR PLANET TRAJECTORY OPTIMIZATION BY THE VARIATIONAL STEEPEST-DESCENT METHOD
Donald S. Hague [1970] 124 p refs
(Contract NAS2-5383)
(NASA-CR-77365) Avail: CFSTI CSCL 22C

The variational steepest-descent method is described in detail. The analysis is first developed for a system consisting of a single stage. Performance, constraint, and trajectory termination criteria may be any functions of terminal state and time. The analysis is then extended to multistage systems. Here, a stage is bounded by two points selected from initial conditions, points of state derivative discontinuity, and terminal conditions. In the multistage analysis the stage-times replace the independent variable time as the independent variable time itself thus becomes an additional state variable. The three-degree point-mass equations of motion for a vehicle maneuvering in the vicinity of a central planet are developed in rectangular rotating coordinates. Planetary characteristics include up to four harmonics in the gravitational field, flattening of the polar axis, layered atmosphere, and wind structure. Vehicle characteristics include generalized aerodynamic and thrust descriptions in terms of up to six control variables. Weighting matrix or control variable metric tensor definitions are presented in some detail. The problem of false convergence induced by ill-chosen weighting matrices is discussed in terms of an order of magnitude analysis. Author

N70-32774*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
METHOD FOR DETERMINATION OF THE ACCURACY OF CLOSED DISTANT STATIONARY ORBITS DETERMINED FROM RANGE RATE
Alton P. Mayo Washington Jul. 1970 31 p refs
(NASA-TN-D-5896; L-7005) Avail: CFSTI CSCL 22C

Orbit-determination-accuracy procedures were derived for inertially fixed orbits about distant bodies. This condition is realized only for binary stars but it is closely approximated over short time periods for orbits about the moon and the planets. Analysis of the results computed by using the stationary-orbit techniques would be indicative of the orbit-determination results computed by using short data arcs on slowly varying orbits. Analytic expressions for uncertainty in the orbit parameters were derived by assuming that a measurement was made every degree of true anomaly. These expressions could be used for other measurement schedules by application of a correction given by the inverse square root of the number of observations. The equations, as presented, are fairly brief and are applicable to short-arc orbit-determination accuracy, linearity, and convergence studies. Author

N70-32803*# Lowell Observatory, Flagstaff, Ariz.
PRELIMINARY OBSERVATIONS OF THE JOVIAN 6190A METHANE BAND
Peter B. Boyce 4 Sep. 1968 5 p refs *Its* Bull. 148, Vol. 7, No. 9 p 93–97
(Grants NsG-451; NGR-03-003-001)
(NASA-CR-110724) Avail: CFSTI CSCL 03B

Photoelectric spectrum scans of small areas of the Jovian surface were made during the spring of 1968. A computer program computed the equivalent width of the 6190 A methane band by comparing the scans to similar scans of the moon. The resulting mean error of a single determination of the equivalent width is 2%. The average equivalent width at the center of the disk was 16.9 A. However, a day to day variation of up to 2 A in the equivalent width was found. The equivalent width also increased with distance from the center of the disk. Author

N70-32815*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
FIREBALLS AND THE PHYSICAL THEORY OF METEORS
Richard E. Mc Crosky and Zdenek Ceplecha 19 Nov. 1969 76 p refs
(Grant NGR-09-015-004)
(NASA-CR-110726; SAO-Special-Rept-305) Avail: CFSTI CSCL 03B

A number of uncertainties and inconsistencies in the classical theory of meteors are discussed. The bulk density of the meteoroid is the least well determined parameter entering the theory and one of the most important. If the densities for some classes of objects are similar to the density of meteoritic stone, then the composition and structure could be accepted as (probably) known, and thus reduce the uncertainties in the physical theory of meteors. On the other hand, low density material is predicted by comet models, and proof of its existence is of substantial importance. An attempt is made to alter the classical theory, following other authors in part, in order to explain observations of faint and bright meteors in terms of a high density. None of the explanations offered by previous authors can be successfully extrapolated to the very bright fireballs. Frothing of the meteoroid becomes less important as the body size increases and less possible as the object penetrates deeper into the atmosphere. Fragmentation by thermal shock becomes decreasingly important as the body size increases, as can be demonstrated both by a mathematical model and by the existence of meteorites of less than the critical size. Author

N70-32821*# National Aeronautics and Space Administration, Washington, D.C.
DETERMINATION OF THE CHARACTERISTICS OF SHADOW BANDS DURING THE TOTAL SOLAR ECLIPSE OF 15 FEBRUARY 1961 [OPREDELENIYE KHARAKTERISTIK BEGUSHCHIKH TENEY VO VREMYA POLNOGO SOLNECHNOGO ZATMENIYA 15 FEVRAL 1961]
A. Derzhanski et al Jul. 1970 4 p refs Transl. into ENGLISH from Compt. Rend. Acad. Bulgare Sci. (Sofia), v. 15, no. 4, 1962 p 365–368
(NASA-TT-F-13114) Avail: CFSTI CSCL 03A

The photoelectric equipment for recording and analyzing the characteristics of shadow bands during a total solar eclipse is described. Author

N70-32847*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PHOTOGRAPHIC OBSERVATIONS OF 10 ARTIFICIAL METEORS
W. G. Ayers, R. E. Mc Crosky, and C.-Y. Shao 5 Jun. 1970 51 p refs
(Contract NSR-09-015-033)
(NASA-CR-110725; SAO-Special-Rept-317) Avail: CFSTI CSCL 03B

A series of meteor-simulation experiments by rocket flights conducted during 1962 to 1967 produced seven iron and three nickel artificial meteors. The results from the photographic observations are presented. The values of the luminous-efficiency factor for these meteors were calculated and a relationship between the photographic luminous efficiency factor and the velocity for the meteoritic iron and stone was derived. Author

N70-32865*# Clarkson Coll. of Technology, Potsdam, N.Y.
EFFECTS ON THE MOTION OF A BODY ATTRACTED BY A ROTATING SOURCE, PART 2 Progress Report
Herbert Knothe May 1970 14 p
(Grant NGR-33-007-034)
(NASA-CR-110634) Avail: CFSTI CSCL 22C

An iterative method to determine the variation of any order of a planned circular orbit about a rotating gravitational source is derived. The iterative method leads to systems of first order in homogeneous differential equation such that the corresponding homogeneous equations have the same form. Then linearly independent solutions are listed explicitly. An application is made in the case of a perturbing axially asymmetric potential. An explicit expression for the first variation of the coordinates of a satellite is derived in the case of a synchronized orbit, i.e., of an orbit the period of which equals the period of the rotating source. The coordinates of the satellite are referred to as inertial systems. Author

N70-33057*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DYNAMICAL EVOLUTION OF DISK GALAXIES
Frank Hohl Washington Jul. 1970 110 p refs
(NASA-TR-R-343; L-7110) Avail: CFSTI CSCL 03B

A computer model for isolated disks of stars is presented and is used to study the self-consistent motion of large numbers of point masses as they move in the plane of the galactic disk. Most disks investigated were found to be unstable against slowly growing long-wavelength modes, and after about two rotations the disks tended to assume a bar-shaped structure. It was also found that the final mass distribution for most disks could be closely approximated by an exponential variation irrespective of the initial mass distribution. To study the development of spiral structure, the model was modified to include a fixed central force similar to that in the Schmidt model of the Galaxy. The mass of the stars in the disk was taken to be from 5 to 50 percent of the total mass of the Galaxy. The evolution of a number of initial distributions of stars was investigaged. The results of the calculations gave a velocity dispersion for the disk stars which was about 50 percent larger than the value of about 30 km/sec found from observation of stars in the solar neighborhood. For some of the disks investigaged, a pronounced spiral structure remained even after 8.5 rotations. Author

N70-33088*# North American Rockwell Corp., Downey, Calif. Space Div.
OBSERVATION REQUIREMENTS FOR UNMANNED PLANETARY MISSIONS, PART 2
A. C. Jones and J. B. Weddell 11 Mar. 1970 161 p refs
(Contract NAS2-4494)
(NASA-CR-73458; SD-70-24) Avail: CFSTI CSCL 22A

The results are presented of a program to define the scientific and engineering objectives for exploration of the outer planets (Saturn, Uranus, and Neptune) and to identify observable phenomena and parameters suitable to remote sensing by imaging and nonimaging techniques that will provide useful information toward satisfying the exploration goals and objectives. Consideration is limited to observations that can, in principle, be performed by remote sensors on flyby and orbiter spacecraft. The most important knowledge requirements relevant to the study objectives concern planetary interior structure, surface composition and topography, and atmospheric composition and meteorology. Visible imagery of outer planet cloud formations, and microwave, infrared, and visible spectrometry and radiometry of radiation absorbed or emitted by all planetary atmospheres, provide the most significant support to the knowledge requirements. D.L.G.

N70-33087*# North American Rockwell Corp., Downey, Calif. Space Div.
OBSERVATION REQUIREMENTS FOR UNMANNED PLANETARY MISSIONS, PART 2: APPENDIXES C AND D
11 Mar. 1970 130 p
(Contract NAS2-5647)
(NASA-CR-73459; SD-70-24) Avail: CFSTI CSCL 22A

CONTENTS:

1. APPENDIX C: OBSERVATION REQUIREMENTS TABULATIONS 130 p (See N70-33088 17-30)
2. APPENDIX D: COMPUTER PROGRAM DESCRIPTION 40 p (See N70-33089 17-30)

N70-33088*# North American Rockwell Corp., Downey, Calif. Space Div.
APPENDIX C: OBSERVATION REQUIREMENTS TABULATIONS
In its Observation Requirements for Unmanned Planetary Missions, Pt. 2 11 Mar. 1970 130 p (See N70-33087 17-30)
Avail: CFSTI CSCL 22A

Planetary observation requirements, appropriate to remote sensing, are presented in the form of computer printouts. The material includes: (1) tables showing the relevant associations of the observation requirements; (2) a listing of the library of titles; (3) a condensed guide to the observation requirements; and (4) a table of detailed observation requirements. D.L.G.

N70-33089*# North American Rockwell Corp., Downey, Calif. Space Div.
APPENDIX D: COMPUTER PROGRAM DESCRIPTION
In its Observation Requirements for Unmanned Planetary Missions, Pt. 2 11 Mar. 1970 40 p (See N70-33087 17-30)
Avail: CFSTI CSCL 22A

A description is presented for the first module of the Space Experiment Requirements Analysis (SERA) computer program. SERA-1 is an input/output program intended for automated retrieval and documentation of quantitative and descriptive planetary observation requirements data. The analysis presented includes: (1) a logical flow diagram; (2) a data output format description; (3) FORTRAN listings; (4) load module and decode maps; (5) sample output tables; and (6) instructions for data preparation. D.L.G.

N70-33100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF OBSERVATIONS IN THE 1967 SPIN PROGRAM
V. M. Grigorevskiy 9 Mar. 1970 44 p refs Transl. into ENGLISH from the book 'Itogi Nablyudeniy po Programme Spin v 1967 Godu' Kishinev, 6 Nov. 1968 p 3–42
(AD-705166; FTD-HT-23-150-70) Avail: CFSTI CSCL 22/3

In accordance with the decision of the Berlin Conference (1966) of the NINS commission, photometric observations for the SPIN program (as well as observations for the INTEROBS program) were made continuously in the 1967 season. A summary is given of the observation results based on data obtained by the coordinator from the various participants. Author (TAB)

N70-33161*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOPAUSE CROSSING OF THE GEOSTATIONARY SATELLITE ATS 5 AT 6.6 EARTH RADII
T. L. Skillman and M. Sugiura Jun. 1970 19 p refs Submitted for publication
(NASA-TM-X-63975; X-645-70-262) Avail: CFSTI CSCL 22C

During the moderate magnetic storm of September 29–30, 1969 an unusually large magnetic field decrease preceded by an impulsive increase of about 100 gamma was observed by the geostationary satellite ATS 5 at about 1733 UT on September 29. The field remained low for about 1 minute and returned to the pre-event level as abruptly as it decreased. From the ATS 1 and 5 observations and magnetograms from ground observatories, it is inferred that the magnetosphere was greatly compressed prior to the above event; the magnetopause distance was probably near 7 earth radii at the subsolar point. Comparing the changes observed by ATS 5 with the field measured by ATS 1 which was 3 hours behind ATS 5 in local time, the event is interpreted as being a magnetopause crossing of ATS 5, caused by a localized, rapid inward motion of the magnetopause and its subsequent recession, creating temporarily an indentation on the magnetopause surface and exposing ATS 5 to the magnetosheath field for a brief period of time. Author

N70-33167*# Techtran Corp., Glen Burnie, Md.
THEORY OF THE GRAVITATIONAL STABILITY OF A ROTATING CYLINDER [TEORIYA GRAVITATSIONNOY USTOYCHIVOSTI VRASHCHAYUSHCHEGOSYA TSILINDRA]
G. S. Bisnovatyy-Kogan et al Washington NASA Jun. 1970 15 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, 1969 p 3–11
(Contract NASw-2037)
(NASA-TT-F-13006) Avail: CFSTI CSCL 20I

The stability of a rotating powder cylinder with respect to perturbances in the plane perpendicular to the axis of rotation is considered. A uniform rotating cylinder with minor deformation is stable. A slightly nonuniform cylinder with opposing clusters of uniform density is unstable with an increase in density from the center. Instability is found in a system comprised of a uniform rotating powder cylinder in a hot environment. The maximum increment corresponds to $Z = 2$, where the density of the cold cylinder is significant compared to the density of the environment. In the case of opposing (clusters) the maximum increment shifts to $Z = 3$. The existence of a maximum increment at $Z = 2$ is associated with the presence of two spiral arms in the majority of spiral galaxies. Author

N70-33175*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW RESULTS AND TECHNIQUES IN SPACE RADIO ASTRONOMY
J. K. Alexander Jul. 1970 51 p refs Presented at the IAU Symp. No. 41, Munich, 10–14 Aug. 1970
(NASA-TM-X-63976; X-693-70-267) Avail: CFSTI CSCL 03A

A summary of all space radio astronomy experiments is presented. Major advances in space radio astronomy have come mainly from experiments conducted on the satellites Alouette-2, Luna-11 and 12, OGO-3 and 5, ATS-2, and RAE-1. Among the most significant technological developments has been the continuing refinement in the accuracy of absolute intensity measurements from approximately + or − 50 percent in the early experiments to + or − 15 to 25 percent in more recent ones. Another important new technique has been the successful use of 229 meter long travelling wave V antennas on the RAE-1 to obtain directive observations of a large portion of the sky at low frequencies. The planned launching of a second RAE spacecraft into a lunar orbit will permit radio astronomical measurements at frequencies down to 30 kHz, facilitate use of the moon as an occulting disk for source position measurements, and provide new information on the cislunar noise environment required to assess the feasibility of future lunar radio observatories. Author

N70-33217*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SITE ACCESSIBILITY AND CHARACTERISTIC VELOCITY REQUIREMENTS FOR DIRECT-DESCENT LUNAR LANDINGS
Vernon J. Weyers Washington Jul. 1970 25 p refs
(NASA-TN-D-5923; E-5630) Avail: CFSTI CSCL 22A

A direct descent is one in which the main descent propulsion system burns continuously from lunar approach to touchdown. The characteristic velocity requirement for direct lunar descents is presented as a function of the landing site location relative to the normal impact point. Results are included for translunar trip times of 60, 75, and 90 hours, for specific impulses representative of

both earth storable and cryogenic propulsion systems, for landing sites located anywhere on the lunar surface, and for ignition thrust to earth weight ratios between 0.12 and 10.0. The data presented are useful in determining approximate performance capability and in evaluating tradeoffs during preliminary mission planning studies. Author

N70-33218*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TESTS AND COMPARISONS OF GRAVITY MODELS USING CAMERA OBSERVATIONS OF GEOS 1 AND GEOS 2
J. G. Marsh, B. C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.), and M. L. Dutcher (Wolf Res. and Develop. Corp., Riverdale, Md.) Feb. 1970 39 p refs
(NASA-TM-X-63972; X-552-70-48) Avail: CFSTI CSCL 22C

Optical observations of the GEOS satellites are used to obtain orbital solutions with different sets of geopotential coefficients. The solutions are compared before and after modification to high order terms and then are analyzed by comparing subsequent observations with predicted trajectories. The most important source of error in orbit determination and prediction for the GEOS satellites is the poorly modeled effect of resonance found in most published sets of geopotential coefficients. Modifications to the sets yield greatly improved orbits in most cases. The sets of coefficients analyzed are APL 3.5, NWL5E-6, Kohnlein (1967), Rapp (1967), Kaula (1967), Smithsonian Astrophysical Observatory (SAO)M-1 (1966), SAO COSPAR (1969) and SAO 1969. The SAO 1969 model generally gives better orbital fits and prediction results than the models quoted above. However even this model can be improved by corrections to resonant coefficients. The results of these comparisons suggest that with the best optical tracking systems and gravity models, satellite position uncertainty can reach 50 - 100 meters during a heavily observed 5 - 6 day orbital arc. Author

N70-33229*# Scientific Translation Service, Santa Barbara, Calif.
PHYSICS OF THE MOON AND PLANETS [FIZIKA LUNY I PLANET]
V. A. Bronshten Washington NASA Jun. 1970 13 p refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1969 p 95 - 100
(Contract NASw-2035)
(NASA-TT-F-13039) Avail: CFSTI CSCL 03B

Reports of papers given at an international symposium on the physics of the moon and the planets in Kiev, October 1938, are given. There was a total of 119 scientific papers given by scientists from Bulgaria, Peru, Poland, USA, France, and Japan. Author

N70-33325*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTEGRATION OF THE RELATIVISTIC EQUATIONS OF MOTION OF AN ARTIFICIAL EARTH SATELLITE
Abolghassem Ghaffari Washington Jul. 1970 12 p refs
(NASA-TR-R-341; G-978) Avail: CFSTI CSCL 22C

The Lindstedt perturbation method is applied to the motion of an artificial earth satellite that moves along a geodesic of the Schwarzschild metric of general relativity. The purpose of this analysis is to determine the extent to which general-relativistic effects are detectable in range measurements of earth-orbiting spacecraft. Author

N70-33385*# Stanford Research Inst., Menlo Park, Calif.
CHEMICAL ORIGIN OF THE VENUSIAN CLOUDS Final Report
Robert C. Robbins May 1970 36 p refs
(Contract NASr-49(25); SRI Proj. PSU-6128)
(NASA-CR-109771) Avail: CFSTI CSCL 03B

Excited atomic hydrogen was used to stimulate partially thermalized and neutralized solar protons expected in the high atmosphere of Venus. Primary reactions of the excited atomic hydrogen with components of the Venus atmosphere were analyzed qualitatively and quantitatively. It was shown that most of the water vapor present must be photodissociated in the predominantly CO2 atmosphere observed a few kilometers above the cloud tops. Most of this water is dissociated into H and OH, less than one quarter into H2 and O. The observed equilibrium concentration of CO is about three times the OH concentration. As no hydrocarbon or organic molecules have ever been detected in the Venus atmosphere, it is presumed that there is no significant concentration of H(P-2) present. Despite the temperature-water vapor pressure enigma at the top cloud level, which remains unsolved, the most likely composition of the Venus cloud is ice. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-32323# Aerospace Corp., El Segundo, Calif.
PROCEEDINGS OF THE SYMPOSIUM ON SPACECRAFT ATTITUDE DETERMINATION. VOLUME 1: UNCLASSIFIED PAPERS
L. J. Henrikson, J. E. Lesinski, and D. Evans 31 Oct. 1969 439 p refs Held at El Segundo, Calif., 30 Sep. - 2 Oct. 1969; Sponsored in part by SAMSO
(Contract F04701-69-C-0066)
(AD-704600; TR-0066(5306)-12-Vol-1; SAMSO-TR-69-417-Vol-1) Avail: CFSTI CSCL 22/2

The symposium included sessions on attitude estimation concepts, attitude sensors and sensing techniques, attitude determination systems, and SPARS. TAB

N70-32327# National Aerospace Lab., Tokyo (Japan).
THERMAL CHARACTERISTICS OF FRP ROCKET NOSE CONE
Koichi Ogawa and Shuji Endo Nov. 1969 23 p refs In JAPANESE; ENGLISH summary
(NAL-TR-185) Avail: CFSTI

The thermal characteristics of fiber reinforced plastic (FRP) nose cones were determined by infrared radiative heating. The temperature rise of four different FRP materials, the inside air of the nose cone, and a steel chip inserted in the nose cone along the axis of rotation were measured. The different materials displayed no significant difference in temperature rise. In the theoretical analysis the conical nose cone was assumed to be composed of a number of thin circular cylinders. The heat balance equation was solved for each cylinder with the aid of finite difference approximation method. The result obtained by numerical calculation was in satisfactory agreement with the experimental result below the temperature at which heat loss due to ablation began. Author

N70-32494*# Louisiana State Univ., Baton Rouge. Agricultural and Mechanical Coll.
GRADUATE ENGINEERING PRACTICE IN MECHANICAL ENGINEERING
5 Jun. 1970 99 p refs
(Contract NAS9-10464)
(NASA-CR-108514; MSC-01500) Avail: CFSTI CSCL 22B

Constraints and design criterial for several possible modes for booster orbiter separation are defined. Equations are derived describing the separation dynamics, and impulse data is being checked to determine that the recontact constraints are met.

Differential equations describing the design of a constant stress bulkhead are derived as well as constraints equations for the system. A preliminary design was established for a 10-man passenger/cargo canister based on projected space station resupply requirements estimates. The advantages of a removeable passenger canister are presented, with the extra space being assigned as an expanded payload volume. The critical abort condition requiring the dumping of the complete supply of propellants immediately after the separation of the orbiter from the booster was studied. The relationship between required oxidizer and fuel dump rates was determined, and safety considerations suggest no simultaneous dumping of liquid oxygen and liquid hydrogen. The quality of the liquids being dumped must be maintained at as high a level as possible and conditions conducive to freezing avoided. E.M.C.

N70-32496# Martin Marietta Corp., Denver, Colo.
STUDY OF SPACE STATION PROPULSION SYSTEM RESUPPLY AND REPAIR Final Report
Victor A. Des Camp, Melvin L. Stephenson, David R. Abbott, Jean C. Du Buisson, and Amalio Marrufo, Jr. Jun. 1970 300 p refs
(Contract NAS8-25067)
(NASA-CR-102774; MCR-70-150) Avail: CFSTI CSCL 22B

The feasibility and practicability of providing a resupply and repair capability for a space station bipropellant propulsion system were determined. The program encompassed a study of inflight maintenance, orbital resupply, reliability, fault isolation and detection, logistics, and safety. Author

N70-32501# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION OF ROCKETS: SELECTED CHAPTERS
A. A. Dmitriyevskiy et al 26 Mar. 1970 380 p refs Transl. into ENGLISH from the book 'Dvizhenie Raket' Moscow, Voyennoye Izd. Min. Oborony SSSR, 1968 p 184-460
(AD-705025; FTD-MT-24-446-69) Avail: CFSTI CSCL 16/2

In this work on rocket motion Chapter 3 deals with the control of rockets and calculation of trajectories. Ninety-two formulas are given in the discussion on control and trajectories. The authors discuss the stability of rocket motion in Chapter 4. The aerodynamics of rockets is discussed in great length, and this chapter contains one hundred eleven formulas. The accuracy of rocket firing and the effect of different factors on rocket flight are dealt with in Chapter 5. Trajectory observations and flight tests of rockets, methods of determining rocket attitude, trajectory measurements by electronic means, and optical and infrared measurements are topics of discussion in Chapter 6. American examples are cited, such as, the American telescope ROTI. Author (TAB)

N70-32574*# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE SHUTTLE TECHNOLOGY REQUIREMENTS
1 Jul. 1970 196 p
(Contract NAS9-10960)
(NASA-CR-108530; SD-70-8) Avail: CFSTI CSCL 22B

One hundred and twenty-two areas have been identified where research and technology development is required in order to assure timely implementation of the Space Shuttle Program. Task descriptions and cost and schedule estimates have been prepared for all items and are submitted to the NASA for consideration and incorporation into their shuttle technology development program. Author

N70-32883*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
GRAVITY GRADIENT BOOM STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE (ATS-E), VOLUME 2 Final Report
Nov. 1969 280 p refs
(Contract NAS5-10285)
(NASA-CR-109581; ATL-338) Avail: CFSTI CSCL 22B

Electrical and mechanical functional tests were performed on a prototype unit of the gravity gradient boom system and included vibration, acceleration, and thermal-vacuum measurements. A detailed summary is presented outlining environmental exposures, facilities and instrumentation used, procedures employed, test data, and the results of environmental qualification testing. Author

N70-32934*# Dudley Observatory, Albany, N.Y.
THE GEMINI MICROMETEORITE COLLECTION EXPERIMENT S-10 Final Report
28 Oct. 1968 19 p refs
(Contract NAS9-5637)
(NASA-CR-108531) Avail: CFSTI CSCL 22A

The purpose, design and execution of the S-10 micrometeorite experiment, flown aboard five of the Agena target vehicles used in the Gemini program, are described. Examination of four polished stainless steel plates, which were exposed to space for four months by means of this experiment, has revealed unequivocal evidence for micrometeorite impact events. The mass distribution of particles in near-earth space derived from measurements of the size and frequency of these events lies below the results from satellite microphone experiments but above those from the Pegasus and Explorer penetration experiments. A biological experiment included in the S-10 package yielded some observations on the ability of certain micro-organisms to survive the space environment. Author

N70-32944*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS OF SERT 2 SPACECRAFT POTENTIAL MEASUREMENTS USING HOT WIRE EMISSIVE PROBES
Sanford G. Jones, John V. Staskus, and David C. Byers [1970] 24 p refs Proposed for presentation at the 8th Elec. Conf., Stanford, Calif., 3 Aug.-2 Sep. 1970; Sponsored by AIAA
(NASA-TM-X-52856) Avail: CFSTI CSCL 22B

Data from the SERT II spacecraft was used to study the variation of spacecraft and ion beam potential with respect to space potential as a function of ion thruster and orbital parameters. Measurements were obtained using floating hot wire emissive probes. Spacecraft potentials of -6 to -11 V with the thruster not operating and -12 to -18 V with the thruster at maximum beam (255 mA) were obtained. The spacecraft potential variations were a function of orbital position. The effect, on spacecraft and ion beam potentials, of varying the ion thruster neutralizer to spacecraft potential was determined. The ion beam-neutralizer potential difference was found to be constant for spacecraft-space potentials from -77 to 0 V with constant neutralizer emission current. Radial potential profiles of the ion beam were also obtained for various spacecraft conditions. Author

N70-33242* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REENTRY VEHICLE LEADING EDGE Patent
Eugene W. Friedrich, inventor (to NASA) Issued 3 Apr. 1962 (Filed 2 Aug. 1960) 8 p Cl. 244-117
(NASA-Case-XLA-00165; US-Patent-3,028,128; US-Patent-Appl-SN-47120) Avail: US Patent Office CSCL 22B

The design of a new and improved leading edge construction for the lifting surfaces of a hypersonic reentry vehicle, capable of withstanding extreme aerodynamic heating and characterized by extreme simplicity of construction, is described. This design utilizes dissimilar structural materials in different thermal environments to advantageously exploit the thermostructural properties of each of the materials. Basically, the construction consists of an elongated nonmetallic generally hollow leading edge member substantially

D-shaped in cross section with the rounded outer surface defining the leading edge of the surface. A slot extends from the hollow interior to the after outer surface of the member at about the vertical midpoint. Also provided is a metallic clip having a forward surface portion abutting the after outer surface of the leading edge. Detailed drawings of the design are included. A.L.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-32012# Naval Civil Engineering Lab., Port Hueneme, Calif.
PRESSURE VESSEL CONCEPTS: EXPLORATORY EVALUATION OF STACKED-RING AND SEGMENTED-WALL DESIGNS WITH TIE-ROD END-CLOSURE RESTRAINTS Final Report, Oct. 1964–Oct. 1965
J. D. Stachiw Mar. 1970 107 p refs
(AD-705125; NCEL-TR-666) Avail: CFSTI CSCL 13/4

An exploratory experimental study was conducted to evaluate the stacked-ring and segmented-wall pressure vessel concepts. The evaluation consisted of testing to destruction stacked-ring and segmented-wall pressure vessel models with tie-rod end-closure restraints and evaluating a series of seal designs utilized in the sealing of the joints between the pressure vessel end closures and the cylindrical pressure vessel body. The test results indicate that the stacked-ring pressure vessel design is approximately 50% heavier than a multilayered pressure vessel of same internal diameter length, material, and pressure capability. The segmented-wall pressure vessel design is approximately 8 to 9 times heavier than a multilayered pressure vessel of same diameter, length, material, and pressure capability. The free-floating, self-energizing radial seal system provided the most reliable and extrusion-proof sealing for vessels with considerable radial dilation and axial end-closure movement. Author (TAB)

N70-32043*# Boeing Co., Seattle, Wash. Aerospace Group.
STUDY OF WELDING DEFECTS: SATURN JOINT CONFIGURATION Final Report
Ned. M. Lowry 15 Jun. 1970 60 p refs
(Contract NAS8-24512)
(NASA-CR-102761; D2-107012-3) Avail: CFSTI CSCL 13E

The results are presented of a program to quantitatively define porosity and weld quality resulting from variations in joint and torch configurations. A specific goal of the program was to determine the weld joint conditions responsible for weld porosity observed in the the production of the Saturn booster. The program objectives were met with the conclusion that mechanical joint defects do not cause porosity in aluminum welds. This conclusion is supported by experimental evidence that joint defects do not cause contamination from the atmosphere under normal conditions and that the components of air do not cause porosity when taken collectively. Further evidence indicates that surface contaimination resulting from normal handling is the most likely source of porosity with lower probability of contamination from tack welds and adsorption of atmospheric water. D.L.G.

N70-32048*# National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.
VACUUM LEAKAGE TESTS OF A SIMULATED LIGHTWEIGHT SPACECRAFT AIR LOCK
Otto F. Trout, Jr. Washington Jul. 1970 46 p refs
(NASA-TN-D-5864; L-7282) Avail: CFSTI CSCL 11A

A simulated air-lock structure was tested under high vacuum to evaluate structural sealing problems and to determine leakage rates. Three different types of hatch configurations and three different seal configurations were tested for a temperature range of from -40 F to 200 F. Leakage rates of less than .0001 cc/sec or less than 10 cc/day of helium (standard temperature and pressure) were attained for each hatch. Author

N70-32059# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMICS OF THIN ELASTIC SHELLS WITH INITIAL STRESSES
I. F. Kirichok 1970 9 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 6, no. 3, 1970 p 16–24
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An analysis of the calculations carried out yielded the following deductions: (1) Under the considered shell heating and endface clamping conditions, the temperature stresses originating can substantially affect the change in natural vibrations frequency, particulary for short shells. (2) The moment of the subcritical state, as the presence of a temperature gradient over the shell thickness affects the lowest natural vibrations frequency insignificantly. E.M.C.

N70-32077# Lockheed Missiles and Space Co., Palo Alto, Calif.
CARRYING CAPACITY OF A STRUCTURE FROM ISOTROPIC MATERIAL WITH DIFFERENT YIELD POINTS TAKING INTO ACCOUNT TEMPERATURE EFFECTS
Iu. P. Listrova et al 1970 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 2, 1970 p 5–8
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The carrying capacity of shells of revolution from an isotropic ideal, rigidly plastic material with different tension and compression yield points is considered. The ultimate equilibrium of plates and shells of revolution with identical yield points is examined, along with the assumption that the material is subject to the Tresk yield condition, with the temperature varying linearly over the shell thickness, and the yield point depending linearly on the temperature. A yield point surface is also constructed for symmetrically loaded shells of revolution. J.A.M.

N70-32082# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuibouwkunde.
THE ANALYTICAL FOUNDATIONS OF A COMPUTER PROGRAM TREATING GENERAL BOUNDARY CONDITIONS ALONG THE EDGE OF A CIRCULAR HOLE IN A CYLINDRICAL SHELL
J. G. Lekkerkerker Mar. 1970 36 p refs
(WTHD-20; Rept-425) Avail: CFSTI

The results of a study aimed at developing a computer program that treats arbitrary boundary conditions along the hole boundary are presented. The research is confined exclusively to the case of a circular cylindrical shell with a circular hole. The material presented includes: (1) The homogeneous solution of the shell equations is accomplished by solving the basic differential equation, obtaining expressions for the stress resultants and stress couples, and determining the displacements. (2) The symmetry aspects of stress distribution resulting from an arbitrary boundary load acting upon the hole boundary and defined. These include doubly symmetric loads, doubly skew-symmetric loads, and cases displaying mixed symmetry. In addition, general formulae for the stresses and displacements in the shell are developed based on the boundary conditions to be enforced. (3) The mathematics to be treated by the computer program is surveyed and the necessary steps involved in developing the program are described. D.L.G.

N70-32131# Naval Postgraduate School, Monterey, Calif.
COMPUTER SIMULATION OF FINITE-AMPLITUDE STANDING WAVES IN RIGID-WALLED DUCTS
Richard Mark Kadlick (M.S. Thesis) Jun. 1969 35 p refs
(AD-705061) Avail: CFSTI CSCL 20/1

The Coppens-Sanders theory for the one-dimensional, nonlinear, acoustic wave equation with dissipative term describing the viscous and thermal energy losses encountered in a rigid-walled, closed tube of large length-to-diameter ratio was applied to finite-amplitude standing waves by the use of the Fast Fourier Transform. Computer programs were written to determine the amplitudes and phases of the first 255 harmonics. Curves of harmonic distortion as a function of the strength parameter were found to be in excellent agreement with available experimental data, to agree with the Coppens-Sanders perturbation analysis, and to extend the theoretically describable regime closer to strengths leading to the formation of the shock front. Author (TAB)

N70-32198# Southwest Research Inst., San Antonio, Tex.
RESPONSE OF STRUCTURAL MATERIALS TO HIGH INTENSITY PURE THERMAL RADIATION Final Scientific Report, 1 Nov. 1964 – 30 Nov. 1969
Ulric S. Lindholm 30 Nov. 1969 12 p
(Contract AF 49(638)-1485)
(AD-703736; AFOSR-70-0835TR) Avail: CFSTI CSCL 13/13

Studies performed have included: (1) stresses induced by radiant surface heating, (2) longitudinal wave propagation in rods with non-uniform temperature distribution, (3) dynamic stability of beams with temperature gradients, (4) formulation of axisymmetric problems in viscoplasticity, and (5) determination of temperature and rate dependent strength properties of metals. Author (TAB)

N70-32199# California Univ., La Jolla.
OPTIMAL STRUCTURAL DESIGN Final Progress Report, 1 May 1968 – 31 Jul. 1969
William Prager and Gilbert A. Hegemier 1970 5 p refs
(Contract DA-ARO(D)-31-124-G1008)
(AD-703917; AROD-7636-8-E) Avail: CFSTI CSCL 13/13

Optimal structural design is concerned with the minimum weight or cost design of a structure subjected to certain service conditions and behavioral constraints. The service conditions may include a wide variety of static or dynamic loads whereas the behavioral constraints take the form of limits on deformation, stress, natural frequency, maximum load capacity, etc. The research fell into three basic categories: (1) general methodology, (2) optimal design of specific structural elements, and (3) optimal layout. TAB

N70-32204# Johns Hopkins Univ., Baltimore, Md.
STUDY OF PLASTIC WAVE CHARACTERISTICS USING ELASTIC WAVES Final Report, Oct. 1964 – Oct. 1969
Robert E. Green, Jr. Aberdeen Proving Ground, Md. Ballistic Res. Labs. Mar. 1970 13 p refs
(Contract DA-18-001-AMC-656(X))
(AD-704698; BRL-CR-8) Avail: CFSTI CSCL 20/12

The influence of plastic deformation on the propagation of elastic waves has been studied. Particular attention has been paid to attenuation as a function of plastic deformation, crystal type and orientation, and rate of deformation. Several interesting phenomena associated with cyclic loading were discovered which exist even for small elastic deformation. Author (TAB)

N70-32209# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
THE STABILITY OF ELASTIC EQUILIBRIUM Final Report
Warner Tjardus Koiter (Ph.D. Thesis—Technische Hogeschool, Delft, 14 Nov. 1945) Wright-Patterson AFB, Ohio AFSC Feb. 1970 327 p refs Transl. into ENGLISH from the Dutch Sponsored in part by Lockheed Missiles and Space Co.
(AD-704124; AFFDL-TR-70-25) Avail: CFSTI CSCL 13/13

A general theory of elastic stability is presented. In contrast to previous works in the field, the present analysis is augmented by an investigation of the behavior of the buckled structure in the immediate neighborhood of the bifurcation point. This investigation explains why some structures, e.g., a flat plate supported along its edges and subjected to thrust in its plane, are capable of carrying loads considerably above the buckling load, while other structures, e.g., an axially loaded cylindrical shell, collapse at loads far below the theoretical critical load. Author (TAB)

N70-32211# California Univ., Berkeley. Structural Engineering Lab.
REFINED FINITE ELEMENT ANALYSIS OF ELASTIC PLASTIC THIN SHELLS OF REVOLUTION
P. Sharifi and E. P. Popov Dec. 1969 122 p refs
(Contract DAHC04-69-C-0037)
(AD-703908; SESM-69-28; AROD-8284-3A) Avail: CFSTI CSCL 20/11

A refined axisymmetric curved finite element for the analysis of thin elastic plastic shells of revolution is described in the report. The improved element is obtained by employing cubic polynomials for the assumed in-plane and out-of-plane displacements in terms of local Cartesian coordinates. This introduces into the solution two internal degrees of freedom in the cord direction of each element. These internal degrees of freedom are removed by static condensation before assembling the individual element stiffness matrices, and are subsequently recovered after the nodal displacements are obtained. On comparison with the previous formulation, this procedure greatly improves the accuracy of the solution especially with regards to inplane stress-resultants at discontinuities in the meridional curvature and interelement equilibrium of forces. The latter fact makes it possible to analyze shells with discontinuous meridional slope. In using this element, improvement in the convergence of the elastic-plastic solutions has been also observed. Complete listing of the modified program written in FORTRAN IV language is given. Author (TAB)

N70-32247# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
AN ENERGY-DISPLACEMENT INEQUALITY APPLICABLE TO PROBLEMS IN THE DYNAMIC STABILITY OF STRUCTURES
L. B. Freund and R. H. Plaut 1969 9 p refs
(Contract N00014-67-A-0191-0009)
(AD-705122) Avail: CFSTI CSCL 20/11

An inequality is derived which relates the strain energy of an elastic beam to its displacement. Generalizations to other structures and applications to problems of dynamic stability are discussed. TAB

N70-32254# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
RESPONSE OF FLEXIBLE PANELS TO TURBULENT BOUNDARY LAYER EXCITATION
James A. Moore Jul. 1969 88 p refs
(Contract N00014-67-A-0204-0002)
(AD-705098; Rept-70208-3) Avail: CFSTI CSCL 13/10

The vibratory response of thin flexible panels excited by turbulent boundary layer pressure fluctuations is measured experimentally in order to investigate the effects of hydrodynamic coincidence on panel response. Experimentally determined cross correlations and cross spectral densities of the panel response are used to investigate the presence of travelling waves in the panel response in comparison with standing wave response. The various mechanisms for damping of panel response are examined. Values for radiation damping coefficients are experimentally evaluated and compared with

analytically derived results. Values for purely mechanical damping coefficients are experimentally determined and compared with values for the total damping in the system that were determined from experiments involving the decay of energy in the panel. The radiation damping in air is shown to be negligible compared with the mechanical damping. The comparisons between damping values show acceptable agreement. Verification of the presence of connected wave patterns in the panel response is obtained only for limited test conditions. Author (TAB)

N70-32354# Naval Ordnance Lab., White Oak, Md.

APPLICATION OF THE HERTZ CONTACT LAW TO PROBLEMS OF IMPACT IN PLATES

Jackson C. S. Yang and Do Sup Chun (Maryland Univ., College Park) 5 Sep. 1969 30 p refs

(AD-704783; NOLTR-69-152) Avail: CFSTI CSCL 13/10

An experimental and theoretical investigation of transverse impact produced by the collision of strikers with steel square plates with and without covering was performed. The purpose of this report is to determine the validity of the static treatment of pressure on thin plates for the dynamic cases of intermediate impact velocities, the use of the Hertz law for the contact of an elastic projectile (steel) on elastic (steel), viscoelastic (Adiprene), and plastic (Lexan) bodies, and the use of viscoelastic and plastic materials as shock mitigators. TAB

N70-32479# Naval Ordnance Lab., White Oak, Md.

COMPUTER PROGRAM FOR A MONOBLOC, HOLLOW, CLOSED-END CYLINDER SUBJECTED TO INTERNAL PRESSURE

Victor C. D. Dawson 27 Feb. 1970 45 p refs

(AD-704787; Noltr-70-41) Avail: CFSTI CSCL 13/4

This report describes a computer program written in BASIC language which calculates the stresses and strains in a monobloc, hollow, closed-end cylinder subjected to internal pressure. Examples of typical calculations are given, including, among others, conditions that cause autofrettage and reverse yielding. Author (TAB)

N70-32562*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

ELASTIC AND PLASTIC ANALYSIS OF PRESSURE VESSEL WELD LANDS WITH MISMATCH

J. Skogh and A. M. C. Holmes May 1970 192 p refs

(Contract NAS9-9726)

(NASA-CR-108516; LMSC-4-05-70-9) Avail: CFSTI CSCL 13M

The problem of weld mismatch in pressure vessels is treated in detail. Design graphs are given for mismatch in cylinders joined to cylinders, and hemispheres joined to cylinders. These graphs, which are in nondimensional form, show elastic and plastic stresses for a wide range of weld land geometries. The material used in generating the data is titanium 6A1-4V, but the design graphs may also be used for other strain-hardening materials with a stress-strain curve that is virtually horizontal in the plastic region. The data which form the basis for the design data have been almost entirely obtained from parametric computer solutions. These solutions were checked with a test program using cylinders and spheres with precisely controlled, simulated mismatch in a variety of weld land configurations. Excellent correlation between theory and test was achieved for static loadings. In addition to static loadings the test program was also designed to provide information on the behavior of pressure vessels with mismatch under pressure cycling. Failure criteria for low cycle fatigue obtained from this work are also included. Author

N70-32728*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.

GRAVITY GRADIENT BOOM STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE (ATS-E). VOLUME 1 Final Report

B. S. Shephard, D. W. Zehner, and O. R. Shively Jan. 1970 275 p refs

(Contract NAS5-10285)

(NASA-CR-109580) Avail: CFSTI CSCL 13M

The material presented is intended to describe the ATS-E boom system and how it functions; to discuss the capability of the system to withstand vibrational and operational loads; to describe the qualification and acceptance testing and the results thereof; and to evaluate the boom system in light of the testing and analysis. Author

N70-32777# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

CONCENTRATED LOADS ON PLATES

Donald E. Nevel Mar. 1970 12 p refs

(AD-703876; CRREL-RR-265) Avail: CFSTI CSCL 8/12

An infinite plate on an elastic foundation is considered for a uniform load distributed over a circular area. The analysis of the problem is based on three-dimensional theory of elasticity. A numerical evaluation for the critical stress is made assuming a bending type of failure and the results closely agree with Westergaards equations. Author (TAB)

N70-32779# Aerospace Corp., San Bernardino, Calif. Technology Div.

THERMAL SHOCK FOLLOWING RAPID UNIFORM HEATING OF SPHERES AND LONG CYLINDRICAL RODS Technical Report, Apr. – Aug. 1968

P. Mann-Nachbar and W. Nachbar 27 Feb. 1970 32 p refs

(Contract F04701-69-C-0066)

(AD-702170; TR-0066(S5816-71)-1; SAMSO-TR-70-58) Avail: CFSTI CSCL 20/11

Stress waves, that develop following rapid uniform internal heating of linear-elastic spheres and long cylindrical rods, display a focussing effect as they proceed radially towards the center in these geometries. This effect can cause peak interior dynamic stresses in both tension and compression that are much larger in magnitude than the magnitude of the uniform compressive stress which is initially induced by constrained thermal expansion. Two fundamental problems are treated by the Heaviside wave method, one for the heating of a long cylindrical core in an infinite medium, and the other for heating of a complete sphere with zero surface traction. A simple closed-form formula for the stress at the center of the cylinder in the first problem allows determination of the effect of a finite heating time (a ramp function) on reducing the amplitude of the peak tensile stress at the center. The peak tensile stress at the center becomes infinite for the cylinder problem in the limit as heating time goes to zero. For the sphere problem, however, the stress at the center is calculated for a duration of several wave-reflection times, and the center stress is found to be finite even for the limit of zero heating time. Author (TAB)

N70-32780# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALYSIS OF BENDING OF A SECTOR PLATE OF VARIABLE THICKNESS, CLAMPED ALONG A PORTION OF ITS ARCUATE EDGE, UTILIZING A HIGH-SPEED COMPUTER

Ya. B. Kantor et al 8 Mar. 1970 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinstroyeniye (Moscow), no. 1, 1962 p 121–124

(AD-704846; FTD-MT-24-424-69) Avail: CFSTI CSCL 13/13

Making the usual assumptions for a thin plate, a plate of variable thickness is assumed to be subjected to a distributed load, to be clamped along a portion of its arcuate edge, and to be free over the remainder of the arcuate edge. The potential energy of the bent plate is expressed in polar coordinates, and a set of equations is derived in terms of the local thickness and

pressure. Three sets of functions have to be solved, and the methods employed were specifically adapted for use with the computer Strela. The subprogramme of differentiation was framed in terms of powers of polynomials, which led to exact solutions. Since it is convenient to express the thickness of the plate and its loading in the form of a Table, the programme included approximate integration over the area of the plate utilizing R. Cotes formula. To obtain an adequate accuracy of integration, a sufficiently fine grid was drawn by dividing each of the three sections of the plate radially into ten equal parts. By proving that certain terms are equal to zero the computer time was significantly reduced. Author (TAB)

N70-32920*# Translation Consultants, Ltd., Arlington, Va.
MOTION OF A CYLINDRICAL PANEL INDUCED BY AN ACOUSTIC SHOCK WAVE [DVIZHENIYE TSILINDRICHESKOY PANELI OT AKUSTICHESKOY UDARNOY VOLNY]
A. G. Gorshkov et al Washington NASA Jul. 1970 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Tverdogo Tela (USSR), Jul.–Aug. 1969 p 85–90
(Contract NASw-2038)
(NASA-TT-F-13113) Avail: CFSTI CSCL 20K

Analysis of the behavior of a finite thin elastic nonshallow cylindrical panel, mounted in a rigid cylindrical frame, under the action of a plane acoustic shock wave whose front is parallel to the generating lines of the panel. The nonlinear differential equations of motion of the panel (which take inertia in the radial, circumferential, and longitudinal directions into account) are integrated by a finite-difference scheme. The reaction of the panel to the shock wave is determined for three sets of boundary conditons. Author

N70-32937*# Techtran Corp., Glen Burnie, Md.
ELASTIC PAYLOAD SUSPENSION WITH GREAT INNER DAMPING, SHOWN IN THE CASE OF A JAVELIN PAYLOAD [ELASTICHE NUTZLASTAUFHAENGUNG MIT GROSSER INNERER DAEMPFUNG, GEZEIGT AM BEISPIEL EINER JAVELIN-NUTZLAST]
J. Stoecker Washington NASA Jul. 1970 15 p refs Transl. into ENGLISH from DGLR Conf. Paper No. 61 Presented at Ann. DGLR Meeting, Bremen, 22-24 Sep. 1969
(Contract NASw-2037)
(NASA-TT-F-13135) Avail: CFSTI CSCL 20K

Discussion of the approach selected for the payload suspension in the Javelin research rocket, which ensures that vibrational accelerations of certain apparatus will not exceed a maximum value of + or – 20 g. The basic characteristics of vibrating systems are examined, and an attempt is made to determine how destructive vibrational forces to which the rocket payload might be subjected can be reduced or eliminated. The method selected is based on the use of viscoelastic materials which have excellent damping properties. The properties of the suspension system and its characteristic parameters are discussed. Author

N70-32950# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AXIAL COMPRESSION OF SANDWICH CYLINDERS AND PANELS WITH CORRUGATED INTERLAYER AND ELASTIC FRAMES
B. A. Panasenko 11 Mar. 1970 21 p refs Transl. into ENGLISH from Samoletostr. Tekh. Nozdush. Flota (USSR), no. 4, 1966 p 52–61
(AD-704837; FTD-MT-24-316-69) Avail: CFSTI CSCL 13/13

The author derives expressions for determining the critical load on cylinders and panels with a corrugated interlayer under compression along the generatrices with transverse elastic framing members. Right circular cylinders and cylindrical and flat panels with outer sheeting of identical thickness are studied. A formula is derived for the potential energy of the entire cylinder, and differential equations are given for determining the minimum potential energy of the system as a whole during loss of stability. By subtracting the equations corresponding to the state of the cylinder before loss of stability from those corresponding to the state of the cylinder after loss of stability, a system of homogeneous linear equations is obtained which is used as a basis in deriving a dimensionless expression for the critical running force taking account of bending, tension and shear in the framing members. Author (TAB)

N70-33059# Advisory Group for Aerospace Research and Development, Paris (France).
EFFECT OF LOADING FREQUENCY ON THE STRAIN BEHAVIOR AND DAMAGE ACCUMULATION IN LOW-CYCLE FATIGUE
D. E. Guecer and M. Capa Jun. 1970 20 p refs
(AGARD-572) Avail: CFSTI

Low cycle fatigue phenomenon is investigated in total strain ranges from 1 to 2 percent, and frequencies from 0.2 to 100 cpm. Changes in endurance life under varying strain and frequency conditions were determined. During the endurance tests changes in the moment and strain values at the critical minimum section of the specimens were recorded. From the continuous time recordings of these parameters, elastic and plastic time ratios of specimen lives were defined and their dependence on strain and frequency levels found. Change of crack propagation rate with frequency was also studied. Finally a cumulative fatigue hypothesis, incorporating both frequency and strain parameters, was formulated and shown to be valid under varying strain and frequency conditions. Author

N70-33095*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COUPLED THERMALLY-INDUCED TRANSVERSE PLUS TORSIONAL VIBRATIONS OF A THIN-WALLED CYLINDER OF OPEN SECTION
Harold P. Frisch Washington Mar. 1970 114 p refs
(NASA-TR-R-333; G-952) Avail: CFSTI CSCL 20K

Long thin-walled cylinders of open section have been used on many satellites either for experimentation or gravity gradient stabilization. Equations for the coupled transverse plus torsional oscillations of a long open section cylinder in direct sunlight are derived. Numerical results show that unstable thermally induced oscillations can be excited solely by the impinging thermal energy of the sun. It is shown that this is a direct result of the boom's extreme weakness in torsion. By literally zippering the boom's open section, to increase its torsional rigidity, the problem can be eliminated. Flight data from OGI IV, V, VI and RAE are cited to support the theoretical findings. Author

N70-33121# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF CIRCULAR CONICAL SHELLS SUBJECTED TO DYNAMIC EXTERNAL PRESSURE
V. V. Kostylev [1970] 11 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 5, 1967 p 480–493
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The stability of circular conical shells closed at the apex and of truncated conical shells subjected to dynamic external pressure or to axial compressive loads is considered. A system of equations is solved for the radical growth upon differentiation and the slight variability upon differentiation with respect to a system of coordinates. Results are obtained utilizing an electronic digital computer. J.M.C.

N70-33147*# Astro Research Corp., Santa Barbara, Calif.
LUNAR ANTENNA MAST: ENGINEERING MODEL Final Report

R. F. Crawford Jan. 1970 18 p
(Contract NAS9-10297)
(NASA-CR-108532; ARC-R-406) Avail: CFSTI CSCL 13M

An automatically erectable and retractable lunar antenna is described. It is a collable-triangular-lattice astromast consisting of three fiberglass longerons interconnected by evenly spaced triangular batten frames, and shear-torsion stiffened by pretensioned diagonal cables. Summaries of the structural analysis, capability, and acceptance tests are included. F.O.S.

N70-33150*# Michigan Univ., Ann Arbor.
COMPARISON OF CORD LOADS WITH A 24 × 7.7 TYPE 7 AIRCRAFT TIRE ON GROOVED AND SMOOTH RUNWAY SURFACES
S. K. Clark and R. N. Dodge Washington NASA Jul. 1970 16 p refs
(Grant NGL-23-005-010)
(NASA-CR-1627) Avail: CFSTI CSCL 13F

In recent years several comprehensive research programs have investigated the effectiveness of runway grooving as a means for increasing tire traction under operational conditions. The results of these studies have shown that pavement grooves provide greatly increased aircraft braking and steering capability for wet, flooded, and slush covered runways. To further investigate the effects of grooved surfaces on tire performance, some experimental measurements of tire cord loads developed on both grooved and ungrooved surfaces are discussed. The groove configurations used were all rectangular or chambered grooves ranging from 3/16 inch by 3/16 inch on 1 inch centers to 3/8 inch on 1 inch centers. Based on test results obtained with a 24×7.7 10 pr Type 7 tire, under slow rolling conditions, tire cord loads are not effected to any significant extent by running on a grooved surface. Author

N70-33222*# Translation Consultants, Ltd., Arlington, Va.
CYLINDRICAL SHELLS OF MINIMUM WEIGHT REINFORCED BY STRINGERS OF A CLOSED PROFILE [TSILINDRICHESKIYE OBOLOCHKI MINIMALNOGO VESA, PODKREPLENNYYE STRINGERAMI ZAMKNUTOGO PROFILYA]
A. S. Palchevskiy Washington NASA Jun. 1970 9 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 6, 1969 p 107–112
(Contract NASw-2038)
(NASA-TT-F-12960) Avail: CFSTI CSCL 20K

Minimal weight cylindrical shells with circular ribs acted upon by an axial load uniformly distributed in a circumferential direction are investigated and computed on the assumption that three cases of loss of stability are possible. It was found that the proposed methodology may be inconvenient for computing values for minimal weight shells reinforced with closed profile ribs. Author

N70-33223*# Translation Consultants, Ltd., Arlington, Va.
ITERATION SYSTEMS FOR COMPUTING THE STRESS STATE OF THIN SHELLS [ITERATSIONNYYE SKHEMY RASCHETA NAPRYAZHENNOGO SOSTOYANIYA TONKIKH OBOLOCHEK]
S. P. Gavelya Washington NASA Jun. 1970 12 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 8, 1969 p 42–49
(Contract NASw-2038)
(NASA-TT-F-12958) Avail: CFSTI CSCL 20K

Differential equations and boundary conditions establishing stressed conditions of finitely deformable thin shells are introduced and explained to show the feasibility of using iterational schemes to compute such stresses. Author

N70-33326*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLUTTER, VIBRATION, AND BUCKLING OF TRUNCATED ORTHOTROPIC CONICAL SHELLS WITH GENERALIZED ELASTIC EDGE RESTRAINT
Sidney C. Dixon and M. Latrelle Hudson Washington Jul. 1970 80 p refs
(NASA-TN-D-5759; L-6663) Avail: CFSTI CSCL 13M

A theoretical investigation has been made of the flutter, vibration, and buckling of truncated conical shells with generalized elastic edge restraint. The shell analysis is of the classical Donnell type, in-plane inertias and structural damping are neglected, and the aerodynamic loading is represented by the inviscid two-dimensional quasi-steady approximation. An approximate solution is obtained by the generalized Galerkin method. The accuracy and limitations of the analysis are illustrated by comparing numerical results for buckling and vibration with results of other investigations for various boundary conditions, applied loads, and shell geometries and stiffnesses. Sufficient numerical results are presented to permit the determination of the flutter condition for simply supported isotropic conical shells for a wide range of cone angle, length-radius ratio, and radius-thickness ratio. Results are also presented to indicate some effects of variations in edge restraint, applied loads, and ring or stringer stiffening. Author

N70-33327*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLUTTER, VIBRATION, AND BUCKLING OF TRUNCATED ORTHOTROPIC CONICAL SHELLS WITH GENERALIZED ELASTIC EDGE RESTRAINT SUPPLEMENT
Sidney C. Dixon and M. Latrelle Hudson Washington Jul. 1970 45 p
(NASA-TN-D-5759-Suppl) Avail: CFSTI CSCL 13M

An analysis of the flutter, vibration, and buckling of orthotropic conical shells is presented in NASA TN D-5759. Certain lengthy expressions which were developed in the analysis are required for complete documentation but were considered to be of interest to only a limited group of readers. This supplement presents these expressions in four sections. The first section gives the details of the solution of the compatibility equations. The second section presents the expressions that appear in the boundary conditions for the stress functions. The third section presents expressions for the matrix elements of the governing stability equation. The fourth section presents expressions for the nondimensional parameters which relate the stiffness and inertia characteristics of end rings to the ring and shell material properties and geometry. Author

N70-33351# Lockheed Missiles and Space Co., Palo Alto, Calif.
PLANE WAVE PROPAGATION IN A TWO-LAYER ISOTROPIC MEDIUM
T. M. Abdullaev et al [1969] 3 p ref Transl. into ENGLISH from Akad. Nauk Uz. SSR (Tashkent), 1969 p 307–310
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Plane wave propagation in a two layer isotropic medium is discussed. Equations of motion and mathematical models are presented. Author

N70-33367*# Translation Consultants, Ltd., Arlington, Va.
EXPERIMENTAL INVESTIGATIONS ON THE VIBRATIONS OF CYLINDRICAL SHELLS CONTAINING A LIQUID [EKSPERIMENTALNYYE ISSLEDOVANIYA KOLEBANIY TSILINDRICHESKOV OBOLOCHKI, SODERZHASHCHEY ZHIDKOST]
V. I. Borisenko et al Washington NASA Jun. 1970 11 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 8, 1969 p 57–62
(Contract NASw-2038)

(NASA-TT-F-12927) Avail: CFSTI CSCL 20K

An investigation of the natural oscillation frequencies of a cylindrical shell partially filled with a liquid is described. The frequencies and mode shapes of the natural oscillations are determined by a resonance method. Satisfactory agreement is established with the theoretical results previously obtained. Author

N70-33381# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMIC STABILITY OF CIRCULAR AND NONCIRCULAR CYLINDRICAL AND CONICAL SHELLS UNDER VARIOUS BOUNDARY CONDITIONS
G. M. Salnikov [1970] 9 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 5, 1967 p 469 - 479
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Equations are derived to describe the vibrations of long and medium cylindrical shells subjected to external pressure with different boundary conditions. Dynamic stability equations are also formulated for reinforced and supported conical and cylindrical shells of arbitrary cross section. R.B.

N70-33396# National Research Council of Canada, Ottawa (Ontario).
AN ANALYSIS OF DISTRIBUTION OF CONTACT POINTS THROUGH THE USE OF SURFACE PROFILES
Yoshitsugu Kimura 1970 17 p refs Transl. into ENGLISH from J. Japan. Soc. of Lubrication Eng. (Japan), v. 11, no. 11, 1966 p 467 - 473
(NRC-TT-1402) Avail: CFSTI

When two surfaces are brought into contact under a normal load, the load is supported by many minute contact points. Mathematical expressions are deduced for the number of the contact points in a unit area of apparent contact, n, and the mean area of each contact point, s, as functions of normal load, plastic flow stress of the material, and some parameters characterizing geometrical nature of the surfaces. First, the surface is expressed as a random function Z = f(x,y) varying about its mean plane, where x and y are orthogonal coordinates on the surface, and x is the local surface height. Then formulas are obtained for n and s, in generalized form, by using three probability distribution functions defining the random function z and its partial derivatives with respect to x and y. In practice, since many surfaces are known to have probability distribution functions as mentioned above which are of Gaussian type, n and s are calculated numerically in this case. The results thus obtained can reasonably explain published experimental data. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-32031*# General Electric Co., Cincinnati, Ohio.
THE Cb-1Zr RANKINE SYSTEM CORROSION TEST LOOP
E. E. Hoffman and J. Holowach Washington NASA Jun. 1970 463 p refs
(Contract NAS3-2547)
(NASA-CR-1509; GESP-246) Avail: CFSTI CSCL 20M

A 5000-hour test was conducted on a two-loop Cb-1Zr system, in which sodium was circulated in the heater circuit and potassium was boiled and circulated in a two-phase secondary loop, which contained turbine simulator test sections of Mo-TZM alloy. Maximum and minimum temperatures in the sodium circuit were 2150 F and 1960 F, respectively, while temperatures in the two-phase potassium circuit ranged from 2000 F (superheated vapor) at the boiler outlet to a minimum of 600 F in the cooler portion of the loop. Operation of the test system was completely satisfactory and extremely stable at the endurance test operating conditions with no significant temperature or pressure fluctuations in the two-phase boiling potassium circuit. Extensive chemical and metallurgical evaluations indicated that the containment alloy, Cb-1Zr, and the candidate turbine simulator alloy, Mo-TZM, have excellent compatibility with the alkali metal environments. No significant corrosion was detected in the system, and the substantial oxygen migration from the hotter to cooler regions of the sodium circuit, which was observed, had no detectable effect on either the strength or the ductility of the Cb-1Zr alloy. Author

N70-32035# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
A SOLUTION FOR RADIATION HEATING OF A DIATHERMANOUS SOLID SUBJECT TO CONVECTION COOLING
Harold J. Breaux Feb. 1970 20 p refs
(AD-704699; BRL-1478) Avail: CFSTI CSCL 20/13

An exact solution is presented for the transient temperature distribution in a semiinfinite solid subjected to monochromatic radiation. The solid is assumed to absorb the radiation according to Lamberts Exponential Law of Absorption and the surface heat loss is governed by Newtons Law of Cooling. For the case of radiation with a spectral distribution the solution is given in the form of a definite integral. Author (TAB)

N70-32045*# Stanford Univ., Calif. Thermosciences Div.
HEAT TRANSFER TO THE HIGHLY ACCELERATED TURBULENT BOUNDARY LAYER WITH AND WITHOUT MASS ADDITION
W. M. Kays, R. J. Moffat, and W. H. Thielbahr Feb. 1969 39 p refs
(Grant NGR-05-020-134)
(NASA-CR-110818; SU-HMT-6) Avail: CFSTI CSCL 20M

Experimental heat transfer data are presented for a series of asymptotic accelerated turbulent boundary layers for the case of an impermeable wall, for several cases of blowing, and suction. The data are presented as Stanton number versus enthalpy thickness Reynolds number. It is known that acceleration causes a depression in Stanton number when the wall is impermeable; suction increases this effect, while blowing suppresses it. The combination of mild acceleration and strong blowing results in Stanton numbers which lie above the correlation for the same blowing but no acceleration. Velocity and temperature profiles are presented, from which it is possible to deduce explanations for the observed behavior of the Stanton number. A prediction scheme is proposed which is demonstrated to quite adequately reproduce the Stanton number results, using correlations derived from the profiles. Author

N70-32049*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ANALYTICAL METHOD FOR STEADY STATE HEAT TRANSFER IN TWO-DIMENSIONAL POROUS MEDIA
Robert Siegel and Marvin E. Goldstein Washington Jul. 1970 35 p refs
(NASA-TN-D-5878; E-5526) Avail: CFSTI CSCL 20M

A general technique was devised for obtaining exact solutions for the heat transfer behavior. Fluid flows through the porous medium from a reservoir at constant pressure and temperature to a region which is at a lower pressure. For the type of flow involved the constant pressure surfaces are at constant velocity potential, so the porous region lies between parallel lines in a complex

potential plane. The energy equation becomes separable when transformed to potential plane coordinates. The general solution for the temperature distribution can thus be obtained in the potential plane and then mapped into the physical plane. Author

N70-32090# ARO, Inc., Arnold Air Force Station, Tenn.
AN EXPERIMENTAL INVESTIGATION OF THE SUPERSONIC COMBUSTION OF VITIATED AIR-HYDROGEN MIXTURES Final Report, 13 May 1968 – 30 Jun. 1969
R. E. Davis AEDC May 1970 36 p refs
(Contract F40600-69-C-0001)
(AD-705129; AEDC-TR-70-60) Avail: CFSTI CSCL 21/5

Tests were conducted utilizing an arc heater as a high enthalpy air source to determine the effects of water vapor contamination on a hydrogen-air supersonic combustion process. A flow apparatus was constructed to permit vitiated, arc-heated airflow to mix coaxially with hydrogen in a constant area duct. The hydrogen was injected at the exit of the vitiated air nozzle which was designed for M = 2.8. Data were obtained in the form of wall pressure distributions and impact pressures and gas samples obtained from nonquenching pitot probes. The enthalpy of the mixture was varied from 1360 to 1860 Btu/lbm and the water vapor mass percent in the vitiated air was varied from 0 to 23. Author (TAB)

N70-32106*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
KINETICS AND THERMODYNAMICS IN HIGH-TEMPERATURE GASES
Washington 1970 150 p refs Conf. held at Cleveland, 19 Mar. 1970
(NASA-SP-239) Avail: CFSTI CSCL 20M

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4. TRANSPORT PROPERTIES OF HIGH TEMPERATURE GASES R. S. Brokaw p 41 – 62 refs (See N70-32110 17-12)
5. EXPERIMENTAL MEASUREMENTS OF DIFFUSION COEFFICIENTS FOR ATOMIC OXYGEN C. E. Baker p 63 – 74 refs (See N70-32111 17-12)
6. TRANSPORT PROPERTIES OF COMPLEX MIXTURES R. A. Svehla p 75 – 88 refs (See N70-32112 17-12)
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8. RATE CONSTANTS FROM IGNITION STUDIES OF THE H2-CO-O2 SYSTEM T. A. Brabbs, F. E. Belles, and R. S. Brokaw p 105 – 117 refs (See N70-32114 17-33)
9. KINETICS OF THE DISSOCIATION OF BROMINE M. Warshay p 119 – 132 refs (See N70-32115 17-12)
10. CHEMICAL KINETIC COMPUTATIONS IN MULTIREACTION SYSTEMS D. A. Bittker p 133 – 146 refs (See N70-32116 17-06)

N70-32109*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMODYNAMICS OF THE INTERNAL COMBUSTION ENGINE
Frank J. Zeleznik *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 31 – 40 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 20M

The internal combustion engine operates on what is known as the Otto cycle, and Otto cycle calculations have been with us for many years. The emphasis in earlier calculations was usually on the performance rather than on the pollution aspects. Performance characteristics can often be estimated reasonably accurately even with a considerable degree of simplification. This study centers on the pollution aspects of the internal combustion engine and its objective is the prediction of exhaust gas properties. Progress is described by first reviewing the Otto cycle and illustration of the effect of various assumptions on the calculated results. Author

N70-32114*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RATE CONSTANTS FROM IGNITION STUDIES OF THE H2-CO-O2 SYSTEM
Theodore A. Brabbs, Frank E. Belles, and Richard S. Brokaw *In its* Kinet. and Thermodyn. in High Temp. Gases 1970 p 105 – 117 refs (See N70-32106 17-33)
Avail: CFSTI CSCL 20B

Reported are systematic measurements so as to isolate the rates of individual bimolecular reaction steps in the complex of six reactions which describe the ignition behavior of the hydrogen - carbon monoxide-oxygen system. Obtained are quite accurate measurements of the rates of the reactions H + O2 yields OH + O and O + H2 yields OH + H. An essential has been a proper accounting of the effects of boundary layer growth on the pressure, temperature, and residence time behind the shock wave. Our measurements of the rates of OH + H2 yields H2O and OH + CO yields CO2 + H are less precise but are perhaps the most direct determinations of these rates for temperatures above 1100 K. Author

N70-32140# Naval Postgraduate School, Monterey, Calif.
AUTOMATIC SHIELD CONTROL FOR A MODERATE TEMPERATURE ADIABATIC CALORIMETER
Herbert Weldon Head (M.S. Thesis) Jun. 1969 31 p refs
(AD-705059) Avail: CFSTI CSCL 14/2

An automatic, electronic controller was designed for use with adiabatic calorimeters. The controller employed reset action, and its behavior at different system gains was analyzed using the analytic techniques of feedback control theory. In accord with the analysis satisfactory performance was obtained with a calorimeter characterized by large thermal lags, but marginal performance was obtained with another calorimeter characterized by a rapid thermal response. A second controller, which employs reset and proportional action gave satisfactory results during preliminary testing for both calorimeters. Author (TAB)

N70-32251# Politecnico di Torino (Italy). Ist. di Meccanica Applicata Aerodinamica e Gasdinamica.
APPROXIMATE STUDY OF THE THERMAL SHOCK
Mario Laudanna and Fiorenzo Quori Nov. 1969 69 p refs
(Grant AF-EOAR-0049-68)
(AD-705187; AFOSR-70-1118TR; SR-5; TN-51) Avail: CFSTI CSCL 20/13

The present method allows us to find a priori, simply and immediately, an approximate expression of the transient temperature distribution in infinite bodies with plane, cylindrical and spherical geometry. The temperature is given as a function of a penetration, whose variation with time is obtained by means of the integral method. The results, obtained for problems whose exact solution is known, prove the accuracy of the present method and allow its extension to still unsolved problems. Some technically interesting boundary conditions (also nonlinear ones as in natural convection and black body radiation) are examined. The non-linear boundary conditions make practically unsolvable the partial differential equation of the transient heat conduction, but do not involve any complication in the present method. This method always leads to a first order ordinary differential equation with seperable variables. The second part is concerned with a method for the determination of temperature profiles in finite bodies: slab, hollow cylinder and

hollow sphere. The evolution of the temperature profile is well described by modifying the expressions used in the case of infinite bodies. Application of the proposed method is recommended by its optimal agreement with known exact results. Author (TAB)

N70-32426# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH TEMPERATURE SOLAR FURNACE
V. A. Baum et al 3 Mar. 1970 9 p refs Transl. into ENGLISH from Geliotekh., Akad. Nauk Uzb. SSR, no. 2, 1969 p 56–59
(AD-704754; FTD-HT-23-62-70) Avail: CFSTI CSCL 13/1

Description of the furnace and the absolute calorimeter for investigation power characteristics of solar power furnaces are given and also power characteristics and the region of temperatures in which thermophysical and radiation properties of refractories can be investigated are presented. Author (TAB)

N70-32471*# Aerojet Liquid Rocket Co., Sacramento, Calif. Engineering Operations.
STABILITY CHARACTERIZATION OF ADVANCED INJECTORS. DESIGN GUIDE FOR STABLE H2/O2 COMBUSTORS. VOLUME 1: DESIGN APPLICATION
May 1970 281 p refs
(Contract NAS8-20672)
(NASA-CR-102758; Rept-20672-P2D) Avail: CFSTI CSCL 20M

The design guide is intended to aid in the design of advanced cryogenic engines using oxygen and hydrogen. The method of analysis is based on the sensitive time lag model. The application of the model is discussed from two approaches. The basic assumption on restriction of the first approach is that losses associated with the nozzle geometry are constant for all modes in the chamber. The gains of the system define the range of frequencies at which instability is likely to occur. Methods for calculating acoustic modes in the chamber are given so that the stability of a specific system may be obtained. The fully characterized system may identify problems concerning unstable modes requiring the use of the devices for corrective action in the design. The second approach allows for a more rigorous and, consequently, more accurate determination of the stability of the system by using the computer model. Included in the design guide are empirical correlations for the commonly used impinging coaxial injector and the conventional impinging orifice injectors. Author

N70-32547# Stanford Univ., Calif. Dept. of Mechanical Engineering.
HEAT TRANSFER TO A TURBULENT BOUNDARY LAYER WITH NON-UNIFORM BLOWING AND SURFACE TEMPERATURE
D. G. Whitten (Shell Develop. Co.), R. J. Moffat, and W. M. Kays Sep. 1969 18 p refs
(Grant NSF GK-534)
(SU-HMT-8) Avail: Issuing Activity

Experimental values of Stanton number are presented for a constant properties turbulent boundary layer subject to non-uniform distributions of blowing and surface temperature. Both the main-stream and transpiration fluid were air. Stanton number is shown to be a function only of local descriptors, enthalpy thickness Reynolds number and blowing parameter, for all smoothly varying boundary conditions. Local behavior is quickly reestablished even after steps in blowing. Data are presented in tabular and graphical form. Author

N70-32566*# Scripta Technica, Inc., Washington, D.C.
COMBUSTION TEMPERATURE OF AEROSOLS OF METAL POWDERS [TEMPERATURA GORENIYA AEROZOLEY METALLICHESKIKH POROSHKOV
B. M. Zlobinskiy et al NASA Jul. 1970 6 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), no. 3, 1969 p 432–434
(Contract NASw-2036)
(NASA-TT-F-13141) Avail: CFSTI CSCL 21B

The effect of the chemical composition of the metallic alloys Zr-Ti, Zr, Si, Ni-Al, and Ni-Ti on the combustion temperature of aerosols of these alloys was investigated. It is found that the combustion temperature of aerosols of all the alloys studied does not depend on the aerosol concentration in the range of small concentrations and is determined not by the ratio of the heat of formation to the specific heat of the oxides, but by the chemical activity of the powders, which depends on the composition of the alloy and on other characteristics of the powder. In the case of refractory silicides of zirconium, an increase in the melting point is found to lead to an increase in the combustion temperature, in spite of a decrease in chemical activity. Author

N70-32569# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
MEASUREMENT OF THERMAL DIFFUSIVITY IN SMALL SAMPLES, JULY–NOVEMBER 1969
David C. Pridmore-Brown 15 Feb. 1970 18 p ref
(Contract F04701-69-C-0066)
(AD-705136; TR-0066(9220-02)-5; SAMSO-TR-70-156) Avail: CFSTI CSCL 20/13

An analysis is presented that relates the thermal diffusivity of a small sample in the shape of a disc to the change in phase across the sample of a thermal wave that is set up in it by irradiating one of its traces with a modulated beam of thermal radiation. This analysis is a generalization of one given by Cowan, who treated the one-dimensional case where the sample was in the form of a thin slab. Numerical results illustrating the importance of two-dimensional effects are included. Author (TAB)

N70-32592# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPROXIMATE METHOD FOR DETERMINING THE HEAT EXCHANGE FROM A SMALL-RADIUS SPHERICAL PARTICLE
L. I. Rudryashev et al 13 Feb. 1970 13 p refs Transl. into ENGLISH from Tr. Aviatsionnyi Inst. (Kuibyshev), no. 24, 1967 p 172–179
(AD-703549; FTD-HT-23-656-69) Avail: CFSTI CSCL 20/13

An approximate method is given of determining the coefficient of heat exchange of a solid spherical heated surface of small radius, placed in a viscous medium in the case of forced, natural or mixed convection. The method is based on the separation of the hydrodynamic and thermal systems in the general system of differential equations and the assumption of the continuity of the functions and parameters appearing in the equations. Author (TAB)

N70-32612 National Lending Library of Science and Technology, Boston Spa (England).
FUNDAMENTAL ASPECTS AND EFFECTS OF DUST FIRES AND DUST EXPLOSIONS [GRUNDLAGEN UND AUSWIRKUNGEN VON STAUBBRAENDEN UND -EXPLOSIONEN]
G. Leuschke Jul. 1969 20 p Transl. into ENGLISH from Betriebssicherheit, no. 10, Oct. 1967 p 365–371
(NLL-SMRE-Trans-5706-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl: 2 NLL photocopy coupons

Explained are the concepts "dust" and "combustion" and some of the parameters are pointed out which have a bearing on the reactivity of dust, viz., "specific surface" and "particle size". Described in detail is the fire hazard due to dust deposits, the danger of a dust explosion when dust is raised, and the possibility

of an explosion of gas liberated during the slow burning of dust. The methods of investigation used for determining hazards due to fire or explosion of dust are reported. Finally, the potential sources of ignition are discussed. Author

N70-32654*# Lockheed Missiles and Space Co., Palo Alto, Calif.
THERMODYNAMIC PROPERTY MEASUREMENTS IN REFLECTED SHOCK AIR PLASMAS AT 12,000 – 16,000 K
Allen D. Wood and Kenneth H. Wilson Washington NASA Jul. 1970 70 p refs
(Contract NAS7-704)
(NASA-CR-1617) Avail: CFSTI CSCL 20M

The thermodynamic properties of the plasma formed in the reflected shock region of a shock tube were measured over a temperature range of 12,000 to 16,000 K. These were diagnostic measurements performed to test the measured temperatures against the gasdynamic temperatures computed in the conventional manner from the conservation equations and the equation of state. The results of this effort were essential to clarify the source of a consistent factor of 2 difference between theoretical predictions (based on gasdynamic temperatures) and experimental results for the total radiant intensity of high-temperature air. Author

N70-32667# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
TEMPERATURES AND THERMAL STRESS IN THIN-WALLED SPHERICAL SEGMENTS SUBJECT TO AN AXISYMMETRIC THERMAL INPUT
B. N. Cassenti and S. V. Nardo Jan. 1970 72 p refs
(Contract N00014-67-A-0438-0003)
(AD-703249; PIBAL-70-2) Avail: CFSTI CSCL 20/4

Transient temperature and thermal stress distributions in thin-walled spherical segments are presented for two cases of axisymmetric aerodynamic heating. The thermal and stress fields are assumed to be uncoupled and the physical properties of the material are independent of temperature. The results, obtained by finite difference methods are presented for a variety of parameters: Nusselt number, radius-thickness ratio, and half-angle. The boundary conditions for the temperature problem correspond to a thermally insulated edge or an edge at zero temperature. The stress boundary conditions were taken as simply-supported or rigidly-fixed. Author (TAB)

N70-32670*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER AND LEVITATION OF A SPHERE IN LEIDENFROST BOILING
Robert C. Hendricks and Kenneth J. Baumeister Washington Jul. 1970 94 p refs
(NASA-TN-D-5694; E-4109) Avail: CFSTI CSCL 20M

The heat-transfer coefficients are predicted for liquid or solid spheres supported in film boiling on a liquid surface (liquid-liquid and solid-liquid film boiling, respectively). For the case of water spheres on a liquid-nitrogen surface, the predicted freezing times compare favorably with experimental measurements. Author

N70-32834*# Colorado School of Mines, Golden. Dept. of Chemical and Petroleum Refining Engineering.
RESEARCH IN PHASE CHANGE THERMAL CONTROL TECHNOLOGY Annual Summary Report, 21 Nov. 1968 – 31 Dec. 1969
J. O. Golden and F. J. Stermole 31 Dec. 1969 17 p refs
(Contract NAS8-30511)
(NASA-CR-102782; ASR-1) Avail: CFSTI CSCL 20M

A program is summarized of research in phase change thermal control technology. Three separate but related phase change studies are presented. They are: (1) A study of the unsteady state temperature response of a phase change test cell with emphasis on the gravity induced free convection effects; (2) A microscopic and thermal study of the solidification of hexadecane, and (3) A study of the thermal modeling of the solidification process for a phase change test cell. Author

N70-32854*# Stanford Univ., Calif. Thermosciences Div.
THE TURBULENT BOUNDARY LAYER: EXPERIMENTAL HEAT TRANSFER WITH STRONG FAVORABLE PRESSURE GRADIENTS AND BLOWING
D. W. Kearney, R. J. Moffat, and W. M. Kays Apr. 1970 219 p refs
(Grants NGL-05-020-134; NSF GK-2201)
(NASA-CR-110653; HMT-12) Avail: CFSTI CSCL 13M

Heat transfer experiments were carried out in air on a turbulent boundary layer subjected to a strongly accelerated free-stream flow, with and without surface transpiration. Stanton number, mean temperature and mean velocity profiles, and turbulence intensity profiles were measured along the accelerated region. The tests were conducted with favorable pressure gradients. The experimental results were used to calculate the distribution of turbulent Prandtl number across the boundary layer. These calculations suggest that a correlation of turbulent Prandtl number which is useful for flow over a flat plate is equally valid in accelerated flows. Using a numerical solution of the appropriate boundary layer equations, the experimental results are predicted with reasonable accuracy, including the effects of various initial conditions and free-stream turbulence intensities. Author

N70-32867*# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
REAL SURFACE EFFECTS ON RADIATIVE HEAT TRANSFER
A. F. Houchens (Ph.D. Thesis) and R. G. Hering Jun. 1970 207 p refs Prepared for JPL
(Grant NGR-14-005-036; Contract JPL-951661)
(NASA-CR-110782; ME-TR-661-1) Avail: CFSTI CSCL 13M

An analytical study of steady radiative heat transfer for a simple system of radiatively interacting opaque surfaces separated by a radiatively transparent medium is presented. Basic principles of radiative transfer are employed to formulate radiative heat transfer for identical, uniform property adjoint plates uniformly irradiated by a collimated radiative flux. The formulation accounts for directional and wavelength dependence of surface properties. The governing equations simplify when bidirectional reflectance may be expressed as the sum of direction dependent specular and scattered components and/or the spectral variation of properties may be approximated by a semi-gray model. Numerical results for local and overall heat transfer were obtained in the absence of external radiative flux and temperature distributions were evaluated for radiatively adiabatic surfaces in the presence of a solar flux. Heat transfer and equilibrium temperature calculations employed bidirectional reflectance models representative of rough metal surfaces and coated surfaces as well as property models incorporating much less detail. Author

N70-32897*# Colorado School of Mines, Golden.
PHASE CHANGE SOLIDIFICATION PHENOMENA FOR THERMAL CONTROL Annual Summary Report, 21 Nov. 1968 – 31 Dec. 1969
A. O. Ukanwa, F. J. Stermole, and J. O. Golden 31 Dec. 1969 182 p refs
(Contract NAS8-30511)
(NASA-CR-102787; ASR-1 Avail: CFSTI CSCL 20M

Solidification as it affects the performance and the suitability of phase-change materials in thermal control devices was studied. A unidimensional mathematical model was established for the solidification of a liquid paraffin of finite geometry. The method was based on the numerical solution by computer of the two-phase heat-conduction equations with moving interface and variable boundary conditions. Constant properties were assumed for each

phase although the properties varied from one phase to the other. An experimental system was set up to verify the theoretical analysis and results. The system consisted of a rectangular cell which was filled with a paraffin, n-hexadecane. The cell itself was cooled from below by a coolant which was circulated by a refrigerator. The solidification process was studied by reading temperatures at different points in the cell by means of copper-constantan thermocouples. Author

N70-32932*# Techtran Corp., Glen Burnie, Md.
BINARY LAMINAR BOUNDARY LAYER OVER A VERTICAL SURFACE WITH COMBINED FREE AND FORCED CONVECTION [BINARNYY LAMINARNYY POGRANICHNYY SLOY NA VERTIKALNOY POVERKHNOSTI SOVMESTNOY SVOBODNOY I VYNUZHDENNOY KONVEKTSII]
P. M. Brdlik et al Washington NASA Jul. 1970 11 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan i Tekhn. Fiz. (Moscow), no. 2, 1969 p 120–125
(Contract NASw-2037)
(NASA-TT-F-13011) Avail: CFSTI CSCL 20M

The study calculates the location of three types of motion modes, free, combined and forced convection, while examining the dynamic and thermal characteristics of a boundary layer with respect to them. Mass transfer with free and forced convections are then indicated. Author

N70-32987*# National Aeronautics and Space Administration, Washington, D.C.
RECENT EXPERIMENTAL RESULTS ON THE COMBUSTION OF ALUMINUM AND OTHER METALS [RESULTATS EXERPIMENTAUX RECENTS SUR LA COMBUSTION DE L'ALUMINUM ET D'AUTRES METAUX]
Michael Barrere Jul. 1970 40 p refs Transl. into ENGLISH from French rept. No. ONERA-TP-735 Presented at AGARD Meeting on Gas-Solid Interactions, Wright-Patterson AFB, Ohio, 13-17 Oct. 1969
(NASA-TT-F-13043; ONERA-TP-735) Avail: CFSTI CSCL 21B

The study of the combustion of metals has recently become important since they are used as a fuel in modern rocket propulsion systems. The ignition delay, burning time of metal particles, combustion efficiency, and the nature of the combustion products are considered in this paper. The first part is devoted to the experimental techniques used for the study of metal combustion. Metal particle combustion and the combustion of metal wires are considered. The second part is a synthesis of the experimental results showing for each metal and in particular for aluminum, berilium, magnesium, and boron, the influence of various parameters, e.g., gas atmosphere, pressure and temperature, influence of surface conditions on the metal at ignition, etc. From these results some combustion models are proposed and are dealt with in the third part. The fourth part relates to a study of combustion in a heterogeneous environment, particularly when the metal is included in a propellant or in a solid fuel. Author

N70-33036# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
AN INVESTIGATION OF HEAT TRANSFER IN THE LIQUID DEFICIENT REGIME
D. C. Groeneveld Aug. 1969 56 p refs Revised
(AECL-3281-REV) Avail: AEC Depository Libraries

Heat transfer data were obtained for forced convection steam-water flow in a 0.760 inch O.D., 0.600 I.D. annulus at pressures between 600 and 1200 psia and mass velocities up to 3 million lbm/h.sq ft. A literature survey of stable film boiling heat transfer covered several fluids at a wide range of pressures and existing theories on film boiling were reported. A variety of correlations were compared with the available world data. Three new correlations were developed: for tubes, annuli, and tubes and annuli combined. The RMS error was respectively 10.1%, 11.2%, and 12.7%. Author (NSA)

N70-33123*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A METHOD FOR THE THERMAL ANALYSIS OF SPACECRAFT, INCLUDING ALL MULTIPLE REFLECTIONS AND SHADING AMONG DIFFUSE, GRAY SURFACES
Doyle P. Swofford Washington Jul. 1970 64 p refs
(NASA-TN-D-5910; L-6063) Avail: CFSTI CSCL 20M

A new method which uses finite surface elements has been developed and used to calculate temperature histories for spacecraft of arbitrary physical geometry. This method assumes gray surfaces with diffuse reflection and radiation properties and accounts for all multiple reflections. The analysis is performed in terms of the Cartesian coordinates of the four corners of each plane quadrilateral element. Shading, or optical blocking, is accounted for in the radiant heat exchange between each pair of surfaces and in the thermal fluxes from external sources which are incident on each surface. This method has been programed for a digital computer and the program can be used as is for the thermal analysis of any spacecraft whose surfaces may be approximated by planar quadrilateral elements which obey Lambert's cosine law. A listing of the program and its auxiliary programs is included in the report. An example problem of a complex, multiwinged earth orbiting satellite is also presented. Author

N70-33202*# Techtran Corp., Glen Burnie, Md.
COMBUSTION IN SUPERSONIC STREAMS FLOWING ABOUT VARIOUS BODIES [GORENIE V SVERKHZVUKOVYKH POTOKAKH, OBTEKAYUSHCHIKH RAZLICHNYE TELA]
P. I. Chushkin Washington NASA Jul. 1970 16 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. ihmat. Fiz. (Moscow), v. 9, no. 6, 1969 p 1367–1377
(Contract NASw-2037)
(NASA-TT-F-13017) Avail: CFSTI CSCL 20M

Combustion zone structural models are introduced in order to simplify the study of supersonic steady state flow over bodies by a combustible gas. The initial mixture and combustion products are examined in a simple model. The concentration of unreacted molecules is used to describe the kinetics of the combustion process. Author

N70-33208# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
HEATRAN: A FINITE ELEMENT CODE FOR HEAT TRANSFER PROBLEMS
W. D. Collier 1970 49 p refs Reprinted
(TRG-REPORT-1807) Avail: AEC Depository Libraries; HMSO 6s; BIS $1.30

HEATRAN is used to solve the heat diffusion equation over a two dimensional area of any shape or material distribution. Transfer by radiation across voids is allowed and special provision is made for narrow gaps. A wide range of boundary conditions are available. Over 1000 nodes may be used in either XY (slab) or RZ (cylindrical) geometry. The data requirements of the program are presented in detail. The use of the program is illustrated, and a brief description of the derivation of the equations is given. Author (NSA)

N70-33238# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A METHOD OF ANALYZING MACHINES WITH BUILT-IN HEAT EXCHANGERS
A. D. Suslov [1970] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (USSR), no. 5, 1970 p 138–141

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The basic aspects of a method for analysis and design of machines with built-in heat exchangers are presented. A distinctive peculiarity of the method is the determination of each of the loss components individually. Discrepancies between the computed and experimental values of the cold productivity do not exceed 5% of the nominal values. Author

N70-33344* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
HEAT SHIELD Patent
Richard B. Erb and Kenneth C. Weston, inventors (to NASA) Issued 28 Apr. 1964 (Filed 5 Aug. 1963) 7 p (Cl. 244-1)
(NASA-Case-XMS-00486; US-Patent-3, 130, 940; US-Patent-Appl-SN-300113) Avail: US Patent Office CSCL 22B

A compact heat shielding for interplanetary space vehicles is described. Using a reflective material under an ablative structure, the shielding is designed to handle large amounts of radiative as well as convective heat. J.A.M.

N70-33380# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHOCK LAYER RADIATION IN THE HYPERSONIC AIR FLOW AROUND BLUNT BODIES
V. P. Stulov et al [1970] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 1, 1970 p 154 - 160
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

It is established that the radiation yield radically alters the temperature field and gas density and has practically no influence on the pressure and velocity. It is further proved that taking account of the radiation in the spectral lines is quite important in solving radiating flow problems. The radiant flux distributions along the contour of a sphere referred to the radiant flux at the stagnation point are approximated, for different values of the free stream velocity and body dimension, by a single parameter of family of functions in which the parameter depends only on the free stream velocity. The radiation flux diminishes considerably more rapidly than the convective flux with distance from the stagnation point. The important conclusion hence follows that the region of the body surface at which radiation heating exceeds convective is concentrated at the forward part of the streamlined body. E.M.C.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-32087# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS, JANUARY – MARCH 1970
J. J. Diamond, ed. Apr. 1970 84 p refs
(NBS-SP-315-5) Avail: SOD $0.75 Catalog No. C-13.10:315-5

The bibliography consists of references to research involving temperatures above 1000 C. Since this is intended primarily as a current-awareness bibliography, there is no cross-referencing or indexing. This issue contains about 750 references roughly grouped under fifteen subject headings covering high temperature chemistry and physics of materials. Author

N70-32154# Ministry of Defence, London (England).
THE IMPACT ON MANAGEMENT OF AUTOMATIC TEST EQUIPMENT IN THE AVIONICS REPAIR ORGANIZATION: THE MANAGER'S VIEW
E. P. Folland *In* AGARD Testing of Airborne Avionics Systems Mar. 1970 (See N70-32151 17-14) 14 p
Avail: CFSTI

A survey to forwarn the prospective automatic test equipment (ATE) purchaser of the problems awaiting him is presented from the manager's viewpoint. The difficulties of selecting line replaceable units for ATE testing, and then obtaining the test data are fully described because they are fundamental to ATE procurement. Author

N70-32324# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
SOCIAL PREFERENCE ORDERINGS AND MAJORITY RULE
Otto A. Davis, Morris H. De Groot and Melvin J. Hinich Oct. 1969 19 p refs
(Grant NSF GP-8824)
(TR-35) Avail: Issuing Activity

The problem of social choice is reexamined and is formulated in a manner which differs importantly from that utilized by Arrow. The new formulation allows certain geometric interpretations and provides recourse to the tools of the probalistic calculus. It demonstrates that certain considerations which were overlooked must be included if our understanding of the problem is to advance. The alternatives available to society are represented by defining them in terms of points in n-dimensional space. Given this conception and a well defined preference function for each individual, majority rule is defined and Arrow's famous paradox is illustrated in terms of a simple example. Conditions are defined for the existence of a unique alternative which will receive a majority against any other alternative. In addition, conditions are given for majority rule to define a transitive social preference ordering. Author

N70-32361# Federal Aviation Administration, Washington, D.C. Information and Statistics Div.
FAA AIR TRAFFIC ACTIVITY, FISCAL YEAR 1969
Viola W. Patterson Aug. 1969 228 p refs
Avail: SOD $1.75

The fiscal year 1969 issue of FAA Air Traffic Activity contains tables and charts which show activity at the FAA-operated facilities. These data reflect the trends and patterns in aviation in the United States and U.S. areas. A summary of the data is shown. Author

N70-32455*# RAND Corp., New York, N.Y.
INTRODUCING TECHNOLOGICAL CHANGE IN A BUREAUCRATIC STRUCTURE
R. B. Hoffman (State Univ. of New York at Buffalo) and R. W. Archibald Feb. 1969 32 p refs Presented at the Ann. Meeting of Acad. of Management, 1968 Sponsored in part by NASA
(NASA-CR-110686; AD-683771; P-4025) Avail: CFSTI CSCL 05A

The paper describes some problems encountered in attempting to introduce technological change into an urban protective service agency. The reward structure in a quasi-military bureaucracy was held as essential to successful introduction of technological change. Author (TAB)

N70-32515# Wisconsin Univ., Milwaukee. School of Business Administration.
TESTING A HYPOTHESIS ON INNOVATION BY MEASUREMENT OF ORGANIZATIONAL GOAL STRUCTURES
Chadwick J. Haberstroh 27 Apr. 1970 13 p refs
(Contract N00014-67-A-0128-0005)
(AD-704808) Avail: CFSTI CSCL 5/1

A set of measures of innovation in an organization is derived from content-analysis of organization communication at successive time points. The data are used to test a hypothesis that innovation in divisionally controlled programs is positively related to division performance. Author (TAB)

N70-32528*# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
PROGRAM OF RESEARCH ON THE MANAGEMENT OF RESEARCH AND DEVELOPMENT: SUPPLEMENTARY LIST OF PAPERS, 1967 - 1969
1969 26 p refs
(Grant NGL-14-007-062)
(NASA-CR-110718; Rept-69/28E-Suppl) Avail: CFSTI CSCL 05A

Progress made during the two-year interval on management research is summarized, reports on the investigations are listed, and the potential for implementation studies at NASA centers is indicated. The general areas of study include the following: idea flow, technology transfer, and information seeking styles; R&D Control and project selection; factors affecting group performance; and strategies for organization and diffusion of R&D in developing countries; and management science utilization and methodology of research on research. N.E.N.

N70-32588*# IIT Research Inst., Chicago, Ill.
TECHNOLOGY APPLICATIONS TEAM Quarterly Progress Report, 1 Jan. - 31 Mar. 1970
F. R. Hand 31 Mar. 1970 79 p refs
(Contract NASw-1953; IITRI Proj. V6102)
(NASA-CR-110648) Avail: CFSTI CSCL 05D

Continuing activities in applying aerospace-generated technology to specific problems in mine safety, law enforcement, and water pollution are briefly described. Significant steps were taken towards the transfer of sodium chlorate candles to breathing apparatus for fireman, aerosol particle analyzers to monitoring dust in coal mines, wind sensors to low velocity air currents in mine galleries, and fiber optic surface gages to the recovery of indented writing. The uses of a pressure transient sensor for coal mine explosion detection and a squib-actuated spray nozzle for the rapid dispersal of an explosion quenching agent are under consideration. Brief discussions are given on problems of mine rescue communications, improved cap lamp for miners, detection and recovery of indented writing, lightweight gas mask and face protector for police, rescue equipment for auto accidents, and reservoir water column density measurement. N.E.N.

N70-32677# National Oceanographic Data Center, Washington, D.C.
GUIDE TO SUBMISSION OF DATA. GENERAL GUIDELINES
Jul. 1969 21 p refs
(AD-704941; NODC-PUB-B-1; TB-1) Avail: CFSTI CSCL 8/1

To facilitate the flow of data into the national repository and to make them available to the general user National Oceanographic Data Center (NODC) is now shifting its emphasis from standard formats to a flexible twofold approach. The originator may send data in his own format, which subsequently will be standardized, and the data will be incorporated into the National Marine Data Base through NODC's general data system. NODC will accept a greater variety of oceanographic material that does not readily lend itself to computerization. The Guide to Submission of Data seeks to define a set of general guidelines that should be considered in submitting data, analytical products, or information to NODC. Author (USGRDR)

N70-32678*# University of Southern Calif. Los Angeles.
TOWARD AN ORGANIZATIONAL ACCOUNTING SYSTEM FOR GOVERNMENT LABORATORIES
Ross Clayton Feb. 1970 36 p refs
(Grant NGL-05-018-098)
(NASA-CR-110760) Avail: CFSTI CSCL 05A

The assessment of a particular type of complex organization, the government laboratory is studied. In recent years a considerable growth has taken place in the amount of funds expended for research and development both in the private sector and in government. Concomitantly, increased concern was expressed about the health and effectiveness of the government's in-house laboratories. One response to the growing interest in developing new methods for evaluating these laboratories is given. A discussion is presented of a rationale and methodology for an organizational accounting system containing a set of measures which should serve to lower the degree of subjectivity required in the assessment process. Author

N70-32749*# Pittsburgh Univ., Pa. Knowledge Availability Systems Center.
EXPERIMENT IN DIRECT PROVISION OF HARD-COPY DOCUMENTATION OF AEROSPACE GENERATED TECHNOLOGY TO POTENTIAL USERS Final Report
Guy W. Mc Gee Jul. 1970 118 p
(Contract NSR-39-011-078)
(NASA-CR-110729) Avail: CFSTI CSCL 05B

During a 12 month operational test the Knowledge Availability Systems Center (KASC) provided document service to 73 clients receiving search services who requested a total of 2,891 document copies. In general, the type of search service providing a user with the greatest number of abstracts resulted in the greatest number of document requests; however, users receiving the least number of abstracts tended to request documents for a greater portion of the abstracts which they received. The KASC responded to 2,802 of the above requests during the 12 month period plus 218 requests received just prior to the beginning of the test. The KASC clientel requested approximately 4% to 5% of the documents announced by NASA in STAR during the year with 1.2 requests being submitted per document. Of the requests, 9% were rejected either because the document was not available to the KASC or the cost of the document exceeded that which the client was willing to pay. Of the documents, 80% were produceable by the KASC; however, 16% were obtainable at less cost to the client through the CFSTI. Three per cent of the documents were obtainable only through sources other than NASA or CFSTI. Documents produced locally were provided to KASC clients in one-fourth the time required to obtain them from other sources. Author

N70-32810# Defense Documentation Center, Alexandria, Va.
MANAGEMENT INFORMATION SYSTEMS, VOLUME 1 Report Bibliography, May 1944 - Oct. 1969
Apr. 1970 282 p refs
(AD-704960; DDC-TAS-70-43-1-Vol-1) Avail: CFSTI CSCL 5/1

The bibliography contains annotated references to the aspects of the management information systems available in the Defense Documentation Centers data bank. Corporate Author-Monitoring Agency, Subject, and Personal Author indexes are included in this bibliography. Author (TAB)

N70-32874# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
INTERFIRM LEARNING AND THE KINKED DEMAND CURVE
Richard M. Cyert and Morris H. De Groot Jan. 1970 20 p refs
(Grant NSF GP-8824)
(WP-57-69-7; TR-38) Avail: CFSTI

The kinked demand curve represents a theoretical dilemma that is not uncommon in the social sciences. The dilemma concerns the inclusion or the exclusion of the theory from the mixed bag represented by the classification oligopoly theory. The kink is embedded in a broader model that incorporates concepts of learning and search behavior. This model reveals conditions under which firm behavior is consistent with the kink and conditions under which it is inconsistent. Both kinds of behavior were observed, and an attempt to develop a theory which explains these phenomena is presented. Author

N70-32876*# New Mexico Univ., Albuquerque. Dept. of Public Administration.

SELECTING RESEARCH INSTITUTIONS FOR THE PERFORMANCE OF PUBLIC SCIENCE ACTIVITIES: CRITERIA FOR INSTITUTIONAL CHOICE IN NATIONAL MINERALS RESEARCH PROGRAMS

Larry M. Lane (M.A. Thesis) Jun. 1970 169 p refs
(Grant NGL-32-004-042)
(NASA-CR-109821) Avail: CFSTI CSCL 05A

The most suitable institutional arrangements are considered which will best meet the national interest in the area of mineral resource development and technology. The requirements of mineral resources management are examined and the institutional practices of national research programs are investigated. Criteria are developed for selecting institutions and alternative institutional possibilities are discussed which lead to specific recommendations for a national mineral resources development institution. Author

N70-32877*# New Mexico Univ., Albuquerque. Dept. of Public Administration.

MANAGEMENT DEVELOPMENT OF SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT: AN ANALYSIS OF BASIC BEHAVIORAL AND SYSTEMS CONSIDERATIONS

Vladimir V. Berniklau (M.A. Thesis) Jun. 1970 127 p refs
(Grant NGL-32-004-042)
(NASA-CR-109820) Avail: CFSTI CSCL 05A

Management development, as a multitude of alternative programs is presented. Prior to examining solutions, the problem must be defined and basic considerations evaluated. The considerations deemed most important are behavioral and systems considerations. Specifically, the transformation from scientist or engineer to competent manager within the federal government is analyzed. A major conclusion is that management development can be a mechanism for mutual satisfaction of organizational and individual needs under certain conditions. These conditions are shown to include a psychologically healthy organization and the use of Theory Y assumptions by top management. An additional conclusion is that a management development program based on a systems approach can serve to smooth the transition from scientist or engineer to manager. Author

N70-32878*# New Mexico Univ., Albuquerque. Dept. of Public Administration.

SCIENCE VS SECRECY IN GOVERNMENTAL AGENCIES: THE PROBLEM AND SOME APPROACHES FOR MINIMIZING THE CONFLICT

Charles A. Buckel (M.A. Thesis) Jun. 1970 77 p refs
(Grant NGL-32-004-042)
(NASA-CR-109822) Avail: CFSTI CSCL 05A

The conflict is discussed in detail, and the factors and approaches that should be considered in establishing classification policies in new science organizations are examined. The statements of scientists were examined in order to identify the reasons for frustrations, objections, and difficulties with classification practices. An analysis was conducted of the legal and situational environment through an examination of public laws, executive orders, and federal court decisions. An analysis was made of sound approaches and practices for a realistic classification program within the confines of the government's. Refined and improved practices can be developed and approaches leading to these practices are analyzed. Author

N70-32879*# New Mexico Univ., Albuquerque. Dept. of Public Administration.

THE PERSONNEL ASSIGNMENT PROBLEM: A SPECIFIC APPLICATION TO THE ASSIGNMENT OF SCIENTIFIC AND EINGINEERING OFFICERS IN THE UNITED STATES AIR FORCE

James A. Bickel (M.A. Thesis) Jun. 1970 111 p refs
(Grant NGL-32-004-042)
(NASA-CR-109823) Avail: CFSTI CSCL 05A

This study considers the assignment problem in general, with a specific application directed at the assignment of scientific and engineering officers in the United States Air Force. By selecting such a specific group, the methodology by which personnel can be optimally assigned was developed. In applying this approach to a specific group, this study addresses four major problem areas which include: (1) the acquisition and quantification of data which describe both the characteristics of the position and the qualifications and perferences of the persons being assigned; (2) the development of a normative mathematical model which calculates the predicted effectiveness of each individual in the positions available; (3) a mathematical technique which, based on the predicted effectiveness ratings, can optimally allocate these individuals to the available positions within the computer time-and-memory constraints; and (4) verification of the model. Author

N70-32880*# New Mexico Univ., Albuquerque. Dept. of Public Administration.

PERSONNEL PERFORMANCE EVALUATION IN RESEARCH AND DEVELOPMENT ACTIVITIES: MOTIVATION THROUGH THE JOB

Richard Eugene Uhrmann (M.A. Thesis) Jun. 1970 169 p refs
(Grant NGL-32-004-042)
(NASA-CR-109824) Avail: CFSTI CSCL 05A

Personnel performance evaluation structured as an integrated part of a management process of work assignment and review which involves participation by the employee is studied as a useful vehicle for employee motivation through the job in government research and development activities. It is concluded that the proposition of is conditionally supported from a conceptual standpoint. Some of the conditions found essential to the workability of are: management philosophy and behavior conducive to a reasonable degree of employee participation in decision in matters relating to his job; challenging work; individual need structures in which the noneconomic motivators are largely prepotent; and supervisors skilled in work planning and organization and human relations. This conclusion is further conditioned by the need for more experimental research on the man-job relationship. An extended period of staff and supervisory training is anticipated to implement the approach. Author

N70-32881*# New Mexico Univ., Albiquerque. Dept. of Public Administration.

ROLES OF SCIENTISTS AND ENGINEERS IN RESEARCH AND DEVELOPMENT CONTRACTING

Larry Glenn Damewood (M.A. Thesis) Jun. 1970 334 p refs
(Grant NGL-32-004-042)
(NASA-CR-109825) Avail: CFSTI CSCL 05A

An overall perspective on the contracting system for research and development is presented and the major roles of scientists and engineers in the process are described. Multiple research techniques are utilized, including interviews and observation of contracting practices. The principal methodology is an analytical descriptive study of the literature, especially government regulatory documents. The evolution of the contract system is traced, and the political,

social, and economic implications of the system are considered. In describing the roles of scientists and engineers, the entire contracting spectrum is covered from early planning to contract management. Research indicates that scientists and engineers have not recognized the contract system as a management tool. Both positive and negative results are noted from the informal relationship between government and nongovernment scientists and engineers. This research is a step toward preparing technical professionals for contracting roles. Author

N70-32882*# New Mexico Univ., Albuquerque. Dept. of Public Administration.

THE IMPACT OF THE CHANGING ENVIRONMENT ON THE MANAGEMENT OF LARGE SCALE PUBLIC SCIENCE PROGRAMS

Robert V. Battey (M.A. Thesis) Jun. 1970 129 p refs

(Grant NGL-32-004-042)

(NASA-CR-109826) Avail: CFSTI CSCL 05A

The objective of this paper is to propose a mechanism for reversing the trend toward ever increasing program costs. Specifically, the proposition is that government contracting agencies should become their own integrating contractor. The primary reason for this proposal is to avoid the huge, long-term contracts that have traditionally required the winning contractor to hire great numbers of additional personnel only to dismiss them again as their portion of the program is completed. Also, by contracting directly with subcontractors, the government can reduce the compounding of overhead charges. Computer technology was seen as a tool for assisting in the accomplishment of future programs without hiring massive, temporary staffs. Current status and suggestions for the utilization of these computers were obtained from recent trade journals and by interviewing key management personnel. Author

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UTILIZING LATERAL ORGANIZATIONAL PATTERNS IN A RESEARCH AND DEVELOPMENT FUNCTION: MISSION PLANNING FOR MANNED SPACEFLIGHT

Leslie James Sullivan (M.A. Thesis) Jun. 1970 220 p refs

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The Apollo mission planning organizational structure, which exhibits singular lateral patterns of organization, is studied. Three working hypothesis are postulated: The mission planning structure is a representative example of the multiple, overlapping group concept; line supervisors are the major factor integrating the activities of the cross-functional groups into overall organization; and the use of multiple, overlapping groups is an extremely valuable tool in achieving coordination. A survey of organizational literature is made to identify relevant concepts, an analysis of the mission planning structure is made based on agency sources, and information is utilized from a questionnaire submitted to members of the cross-function groups. It is concluded that the hypotheses are verified. It is also suggested that the concept of cross-functional groups may have an important implication for effective committee usage and the managers systematically consider lateral coordination patterns in designing and updating their organizations. Author

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CHRONICLE OF THE SPACE ERA [LETOPIS KOSMICHESKOY ERY]

A. Krylov Washington NASA Jul. 1970 7 p refs Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 10, Oct. 1969 p 40–41

(Contract NASw-2037)

(NASA-TT-F-12950) Avail: CFSTI CSCL 05F

The various books on Soviet space achievements and Soviet cosmonauts published to date by various publishing houses, giving titles of the books and names of their authors are listed. The future plans of the publishing houses are also discussed. Author

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A new space vehicle design criteria publication in the series on chemical propulsion. This monograph presents NASA's specific guidelines and practices for the design of motor cases to meet mission objectives. Tasks discussed are case configuration, material selection, case design, case fabrication, and inspection and testing. *Paperbound.* 112 pp. Available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, for $3.00.

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